Scotsman®
ICE SYSTEM

MV 100

SERVICE MANUAL

MV 100 – Table of Contents

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How To Use This Manual

Scotsman provides this manual as an aid to the service technician in installation, operation, and maintenance of MV 100 series (electro-mechanical) cube ice machines. If used properly this manual can also help the service technician troubleshoot and diagnose most of the problems that may occur with the machine.

The first two sections of this manual provide general and maintenance information. The remainder of the manual beginning with section C provides troubleshooting and service information. Section C contains flow charts called troubleshooting trees. Page C-l provides instructions on using the troubleshooting trees. Each troubleshooting tree is named to describe a particular problem with the operation of the machine. When following the troubleshooting trees the service technician will be led through questions and checks and end up at a probable solution. When using the troubleshooting trees it is important that the service technician under- stand the operation and adjustments of the components being checked and the component suspected of malfunctioning. A detailed description of the operation and adjustments of the components as well as other service information is laid out in the pages that follow section C.

Sections D, E and F focus on a particular system in the ice machine; water distribution system, refrigeration system, and it is important that these sections be used together with the Troubleshooting Trees in section C.

Most aspects of the MV 100 series machines are covered in this manual, however, should you encounter any conditions not addressed herein, please contact the Scotsman Europe Service Department for assistance. You may also fax, E-mail or write the Scotsman Europe Service Department:

Scotsman Europe
Via Europe 9
Pogliano M.se
Italy
Attn: Technical Service Department

Phone: ++390331589305

Fax: ++390331584306

Any service communication must include:

- **Model Number**
- **Serial Number**
- **A detailed explanation of the problem**

Electrical and Mechanical Specifications

Model Number	Ice Production per 24 hrs 32°C (90°F) Air 21°C (70°F) Water		Cooling capacity		Voltage	Rated Power Consumption kW	Fuse Size	**Refrigerant		
	Kg	Lbs.	Watts	BTUH				Type	Gr.	Oz
MV 100 W	775	1700	8670	29600	230/50/1	3.30	30	R 404A	1400	50
MV 100 R	680	1500	8700	29750	230/50/1	4.92	50	R 404A	11350	400

Installation Guidelines

Note: **Installation should be performed by an Scotsman Trained Service Technician.**

For proper operation of the SCOTSMAN ice machine the following installation guidelines must be followed. Failure to do so may result in loss of production capacity, premature part failures, and may void all warranties.

Ambient Operating Temperatures

Minimum operating temperature: 10°C (50° F)
Maximum operating temperature: 43° C (110° F)

Incoming Water Supply

Minimum water temperature: 5°C (40° F) Maximum water temperature: 38° C (100° F) Minimum water pressure: 1.5 bar (20 psi) Maximum water pressure: 4 bar (60 psi)

Note: If water pressure exceeds 4 bar (60 psi), a water pressure regulator must be installed.

Water Filtration

A water filter should be installed with all ice machines.

See Plumbing Diagram for line sizing, see page 5.

Clearance Requirements

Self contained air cooled machines must have a minimum of 15 cm (6")of clearance at the rear, top and at the sides of the machine that allow air circu1ation.

Stacking

If machines are to be stacked refer to instructions in stacking kit.

Electrical specifications

Refer to serial plate at rear of machine or the charts on page 4.

Adjustments

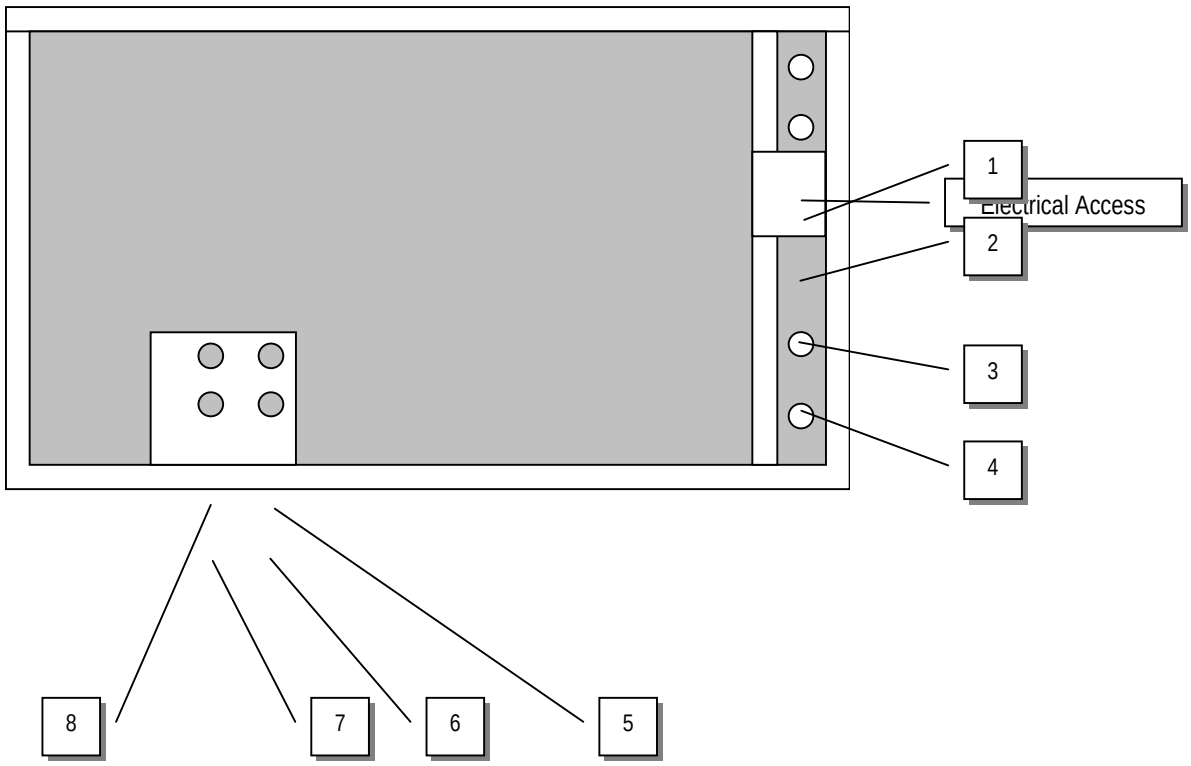
Level machine.
Check bin control for proper adjustment, page 46.
Check water in trough for proper level, page 29
Dl. Check ice bridge for proper thickness, page 41.
Check cam switch adjustment, page 44.
Check water regulating valve adjustment if water cooled, page 32.

Electrical and Plumbing Requirements

Electrical and Plumbing Sizing

1 Electrical Inlet: 7/8" hole for remote
2 Electrical Inlet: 7/8" hole
3 Water inlet fitting: 3/8" FPT
4 Purge drain: 3/4" FPT
5 Water cooled condenser drain fitting: 1/2" FPT
6 Remote condenser discharge line fitting: 1/2" quick-connect
7 Remote condenser liquid line fitting: 3/8" quick-connect
8 Water cooled condenser inlet fitting: 3/8" FPT

MV 100 Models

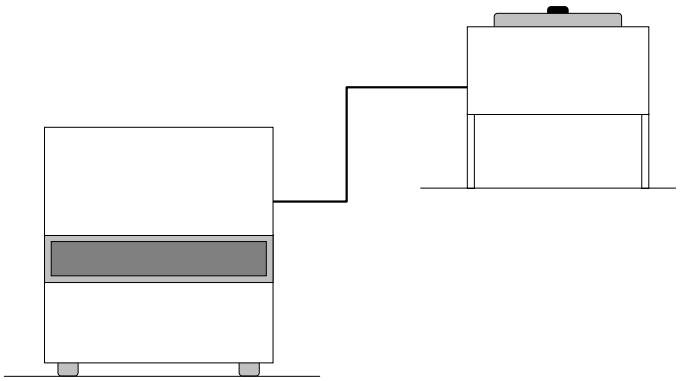


Remote Condenser Installation

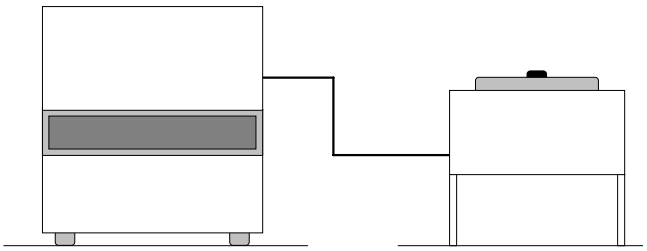
For proper operation of the SCOTSMAN ice machine the following installation guidelines must be followed. Failure to do so may result in loss of production capacity, premature part failures, and may void all warranty.

Installation Guidelines
-Ambient operating temperatures: -28°C (-200°F) to 43°C (110°F) -Maximum refrigerant line length: 12 m (40 ft.) -Maximum vertical rise: 4.5 m (15ft.)
-Minimum condenser height: MV 100 Series ice machine remote condensers must not be installed more than 1.8 m (6') below the refrigerant line quick connects at rear of ice machine. No part of the refrigerant lines, between the machine and condenser, should fall below this point. Condensers for all other machines addressed in this manual must be installed above quick connect fittings at rear of machine.

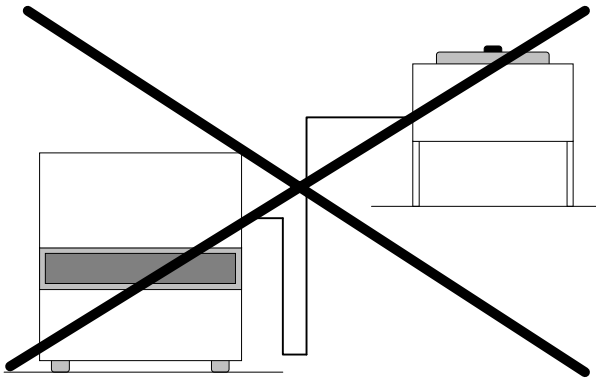
When installing the condenser above the machine:
DO Slope refrigerant lines downward toward compressor



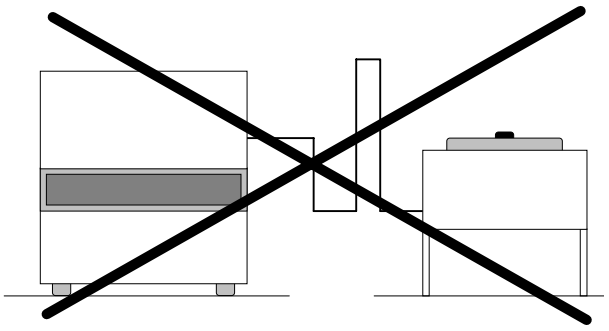
When installing condenser below the ice machine
DO Add 1.4 kg (3 lbs.) of refrigerant to system.
DO Slope refrigerant lines downward toward condenser



DO NOT install any part of the refrigerant lines below the quick connect fittings at rear of machine



DO NOT Install the condenser lower than 1.8 m (6') below the connect fittings at rear of machine
DO NOT Create oil traps in refrigerant lines by sloping lines downward then rising upward



Connecting Precharged Line Sets
Before connecting line set fittings to the macl1ine and condenser lubricate threads and o'rings with refrigerant oil. Leak check connections after connecting.

How the Machine Works

A general description of how the MV 100 Series cubers work is given below. The remainder of the manual provides more detail about the components and systems.

With the ICE/OFF/WASH switch in the ICE position, the compressor, water pump, and condenser fan motor (air cooled machines only) will energize starting the freeze cycle.

During the freeze cycle water is circulated over the evaporator where the ice cubes are formed. When the suction pressure has pulled down to the proper cut-in pressure of the timer initiate (pressure control), the contacts close energizing the time delay module (timer). See page **40** for the proper timer initiate setting. At this time the cubes will be close to completion. The remaining portion of the freeze cycle is determined by the timer setting. The timer is pre-set at the factory to achieve the proper ice bridge thickness but may need to be adjusted upon initial start-up, see page 41.

Once the amount of time on the time delay module has past, the machine enters harvest. Power is now supplied to the water purge valve, hot gas valve, and the harvest assists motor. The water purge valves opens and allows the water pump to purge the water remaining in the water trough, removing impurities and sediment. This allows the machine to make clear ice cubes and keep mineral build-up at a minimum. The hot gas solenoid opens allowing hot gas to go directly to the evaporator, heating the evaporator and breaking the bond between the evaporator and the slab of ice.

The harvest assist motor, which is also energized during harvest, turns a slip clutch which pushes a probe against the back of the ice slab. Once the evaporator has reached approximately 5°C (40°F) in temperature, the slip clutch overcomes the bonding of the ice to the evaporator and pushes the slab of ice off the evaporator and into the bin. The clutch also actuates a switch that rides on the outer edge of the clutch. When the clutch makes one complete revolution the switch is tripped and the machine enters the next freeze cycle.

When the ice drops into a full bin during harvest the splash curtain is held open, tripping a bin switch, and the machine will shut off. When the ice is removed from the bin the splash curtain will close and the machine will come back on.

Maintenance

Note: **Maintenance should be performed by an Scotsman trained Service Technician.**

Danger! Electrical shock and/or injury from moving parts inside this machine can cause serious injury. Disconnect electrical supply to machine prior to performing any adjustment or repair.

Warning!
Failure to perform the required maintenance at the frequency specified will void warranty coverage in the event of a related failure.

To insure economical, trouble free operation of the machine, the following maintenance is required every 6 months.

Maintenance Procedure

1. Clean the ice-making section per instructions below Cleaning should be performed a minimum of every 6 months. Local water conditions may require that cleaning be performed more often.

2. Check ice bridge thickness. See page 41. for proper thickness and adjustment procedure.

3. Check water level in trough. See page 29. for proper level and adjustment.

4. Clean the condenser (air cooled machines) to insure unobstructed air flow:

5. Check for leaks of any kind; water, refrigerant, oil, etc.

6. Check the bin switch far proper adjustment, see bin switch adjustment on page 46.

7. Check the cam switch Setting, see page 45.

8. Check water regulating valve (water cooled machines) for proper adjustment by measuring water temperature, see page 32.

9. Check all electrical connections.

Cleaning and Sanitizing Instructions

Harvest problems may occur if the following procedures are not performed every 6 months.

1. Remove ice machine front panel.

2. Make sure all ice is off evaporator. If ice is being made, wait for cycle completion, then turn machine "OFF" at the ICE/OFF/ WASH switch.

3. Remove or melt all ice from the bin.

4. Add recommended amount of approved ice machine cleaner to water trough according to label instructions on container.

5. Initiate the wash cycle at the ICE/OFF /WASH switch by moving switch to the "WASH" position. Allow the cleaner to circulate for approximately 15 minutes to remove mineral deposits.

6. Depress the purge switch and hold until cleaner has been flushed down the drain and diluted by fresh incoming water.

7. Terminate the wash cycle by moving the ICE/OFF /WASH switch to the "OFF" position. Remove the splash curtain and inspect the evaporator and water spillway to assure all mineral residue has been removed.

8. If necessary, wipe evaporator, spillway and other water transport surfaces with a clean, soft cloth to remove remaining residue. If necessary, remove the water distribution tube, disassemble and clean with a bottle brush, see page D-2. Reassemble all parts and repeat steps 4 through 7 as required to remove residue.

9. Turn off machine water supply and clean water trough thoroughly to remove all scale or slime build-up. If necessary, remove trough to reach all splash area and float.

10. Prepare 6 to 7.5 liters (1-1/2 to 2 gallons) of approved (EPA/FDA) sodium hypocloride food equipment sanitizer to form a solution with 100 to 200 PPM free chlorine yield.

11. Add enough sanitizing solution to fill the water trough to overflowing and move the ICE/OFF/WASH switch to the "WASH' position and allow circulation to occur for 10 minutes and inspect all disassembled fittings for leaks. During this time, wipe down all other ice machine splash areas, plus the interior surfaces of the bin, deflector and door with the remaining sanitizing solution. Inspect to insure that all functional parts, fasteners, thermostat bulbs (if used), etc. are in place.

12. Depress the purge switch and hold until sanitizer has been flushed down the drain. Turn on the machine water supply and continue to purge the diluted sanitizing solution for another 1-2 minutes.

13. Move the ICE/OFF/WASH switch to the "ICE" position and replace the front panel.

14. Discard the first two ice harvests.

Winterizing Procedure

Important

Whenever the ice machine is taken out of operation during the winter months, the procedure below must be performed. Failure to do so may cause serious damage and will void all warranties.

1. Shut water off to the machine.

2. Turn the ICE/OFF /WASH Switch to the off position.

3. Make sure all ice is off evaporator. If ice is being made, initiate harvest or wait for cycle completion, then turn machine "OFF" at the ICE/OFF/ WASH switch.

4. Disconnect the tubing between the pump discharge and the water distributor manifold.

5. Drain the water system completely. Do not replace the tubes.

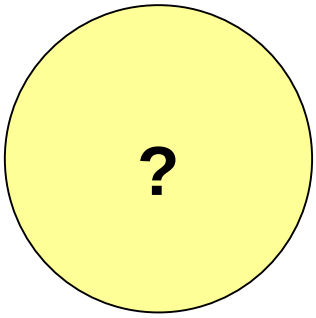
6. On water cooled machines, hold water regulating valve open by prying upward on the spring with a screwdriver while using compressed air to blow all the water out of the condenser.

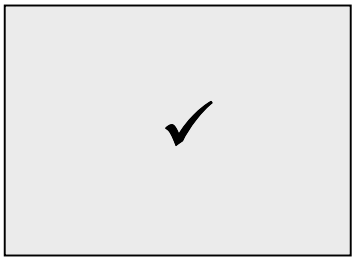
7. Wipe out the storage bin.

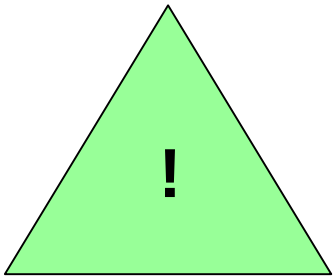
How To Use The Troubleshooting Trees

The troubleshooting trees were developed to be used in conjunction with the service information in the sections that follow If used together as intended, these two part of the manual will allow the ice machine service technician to quickly diagnose many of the problems encountered with ice machines. When used as designed, the troubleshooting trees can lead you from a general symptom to the most likely component to suspect as the cause of the problem. The trees are not designed to be "parts changer guides; please do not use them as such! Components returned to the factory for warranty are tested by the factory and will not be covered under the warranty policy if they are not defective. Please refer to page 3 for instructions on using the entire manual.

The trees are made of three types of boxes:







QUESTION boxes ask a yes/no question and the answer will lead to either another question box, a check box, or a solution box.

CHECK boxes will suggest a point to check for proper operation, and will often refer you to a page in the service information sections of this manual. The result of the check may lead to another box, or a solution box.

SOLUTI0N boxes suggest the most likely component to cause the malfunction described in the heading of the tree. When reaching a solution box, **Do Not** immediately assume the component is defective. The final step is to verify that the component is indeed defective, by using the service information in the sections that follow:

To use the troubleshooting trees, first find the page with the heading describing the type of problem occurring. Begin at the top of the page and follow the tree, step-by-step. When a check box is reached, it may be necessary to refer to another section in the manual. Once a solution box is reached, refer to the appropriate section to verify that the component in the solution box is, indeed, the problem. Adjust, repair or replace the component as necessary.

Troubleshooting Trees

Machine Does Not Run 12

Machine Runs, Does Not Make Ice .... 13 & 14

Slow Production (Cube Formation Good) 15

Low **Suction** Pressure 16

High Suction Pressure 17

Cubes Are Hollow 18

Uneven Bridge Thickness 19

Ice Bridge Thickness Varies Cycle To Cycle 20

Machine Produces Cloudy Ice 21

Poor Water Distribution Over Evaporator.... 22

Machine Does Not Enter Harvest....23

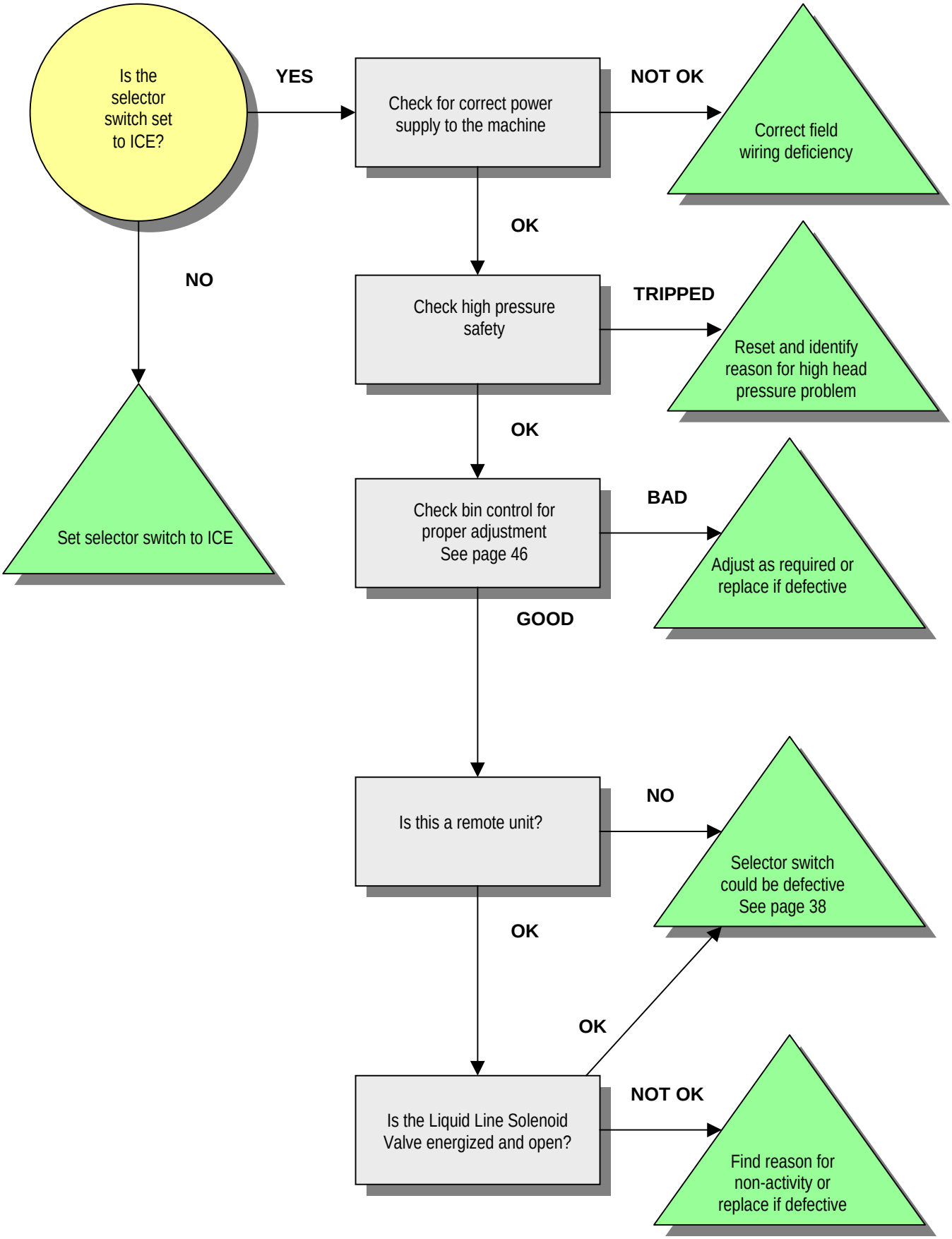
Machine Enters Harvest, Then Returns To Freeze Prematurely 24

Length Of Harvest Excessive....25

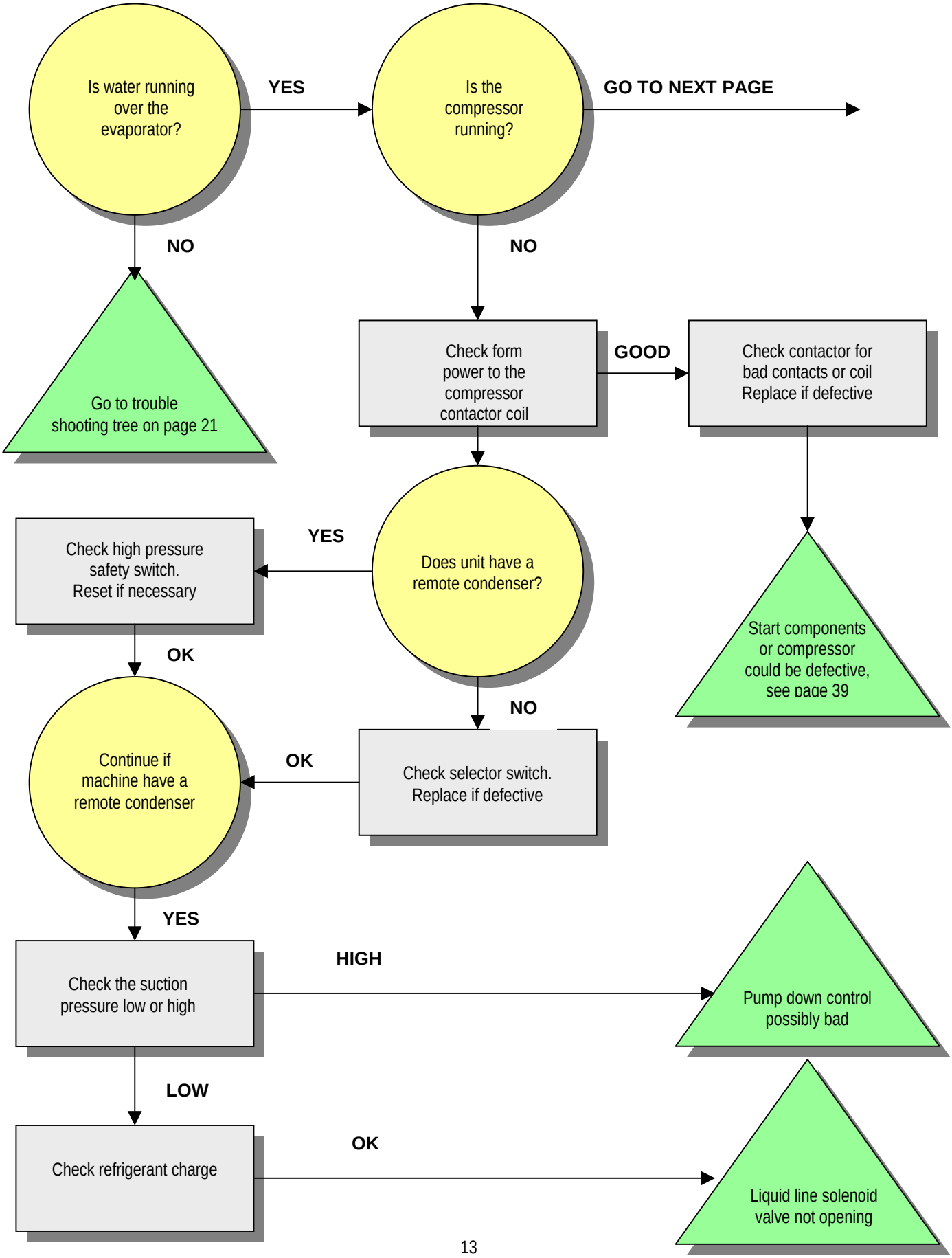
Ice Does Not Release From Evaporator 26-27

Hot Evaporator, Low Suction Pressure (Remotes Only) 28

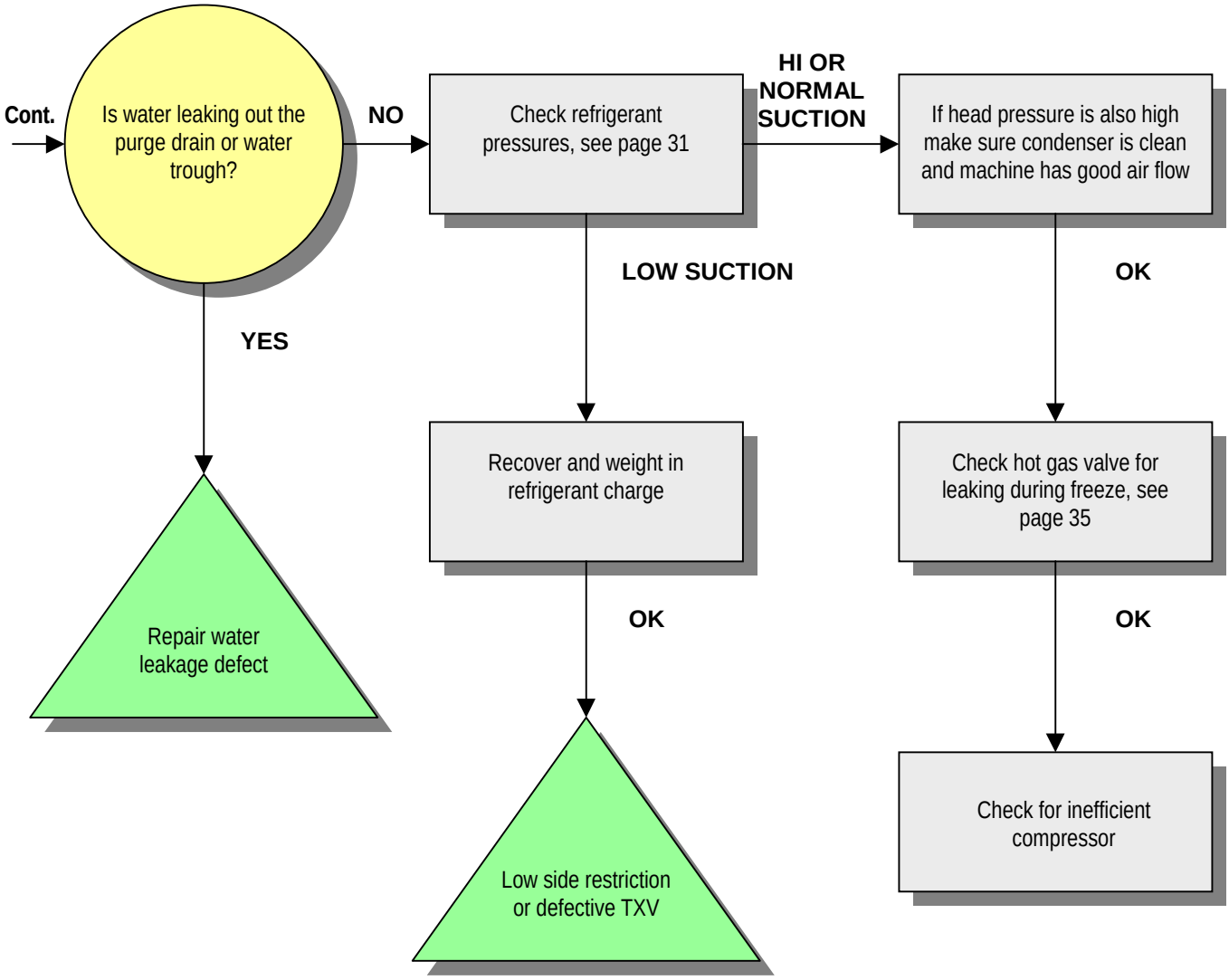
Machine Does Not Run


Is the selector switch set to ICE?
YES
NO
Check for correct power supply to the machine
NOT OK
Correct field wiring deficiency
OK
Check high pressure safety
TRIPPED
Reset and identify reason for high head pressure problem
OK
Check bin control for proper adjustment See page 46
BAD
Adjust as required or replace if defective
GOOD
Set selector switch to ICE
Is this a remote unit?
NO
Selector switch could be defective See page 38
OK
OK
Is the Liquid Line Solenoid Valve energized and open?
NOT OK
Find reason for non-activity or replace if defective

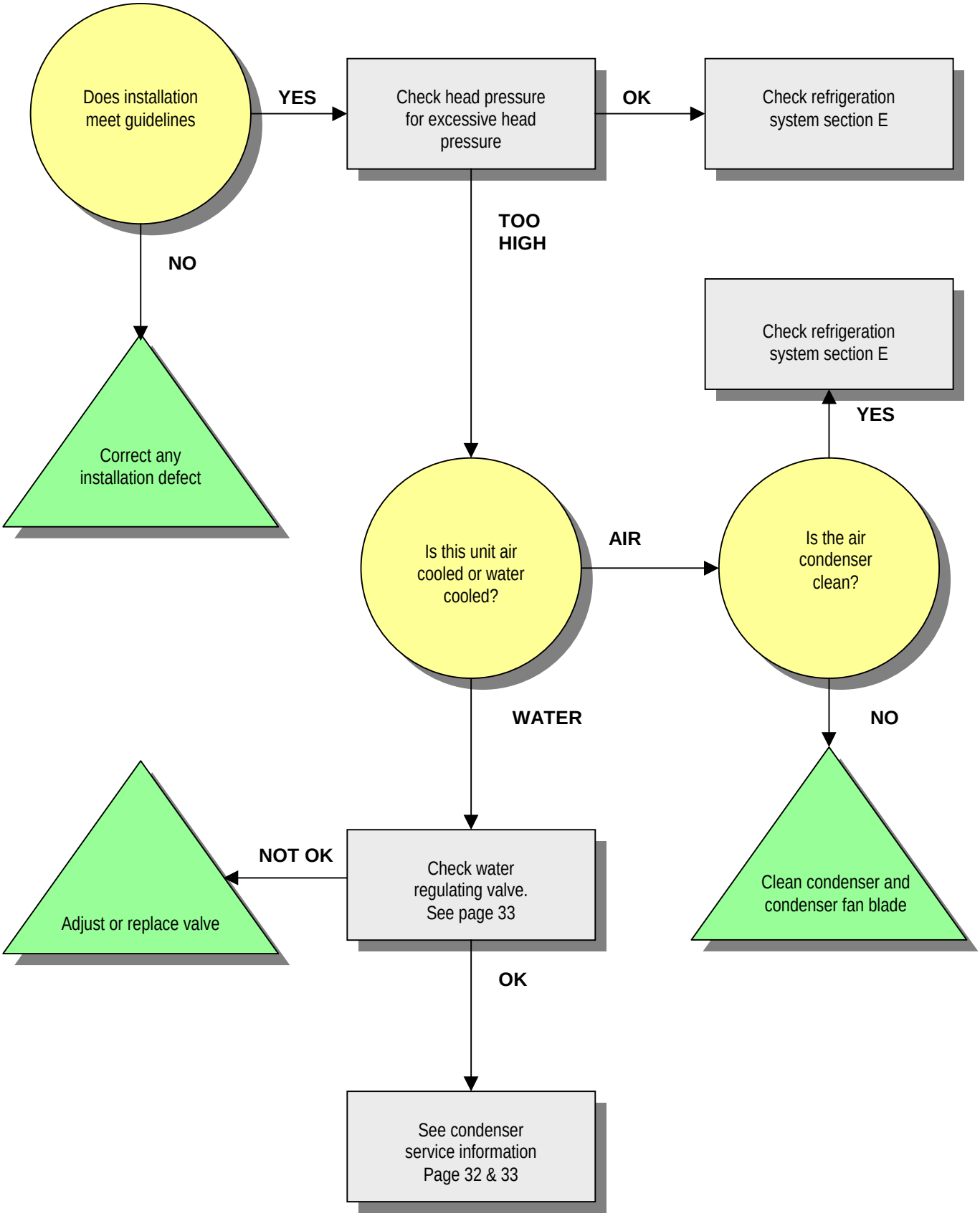
Machine Runs, Does Not Make Ice


Is water running over the evaporator?
YES
Is the compressor running?
GO TO NEXT PAGE
NO
NO
Go to trouble shooting tree on page 21
Check form power to the compressor contactor coil
GOOD
Check contactor for bad contacts or coil Replace if defective
Does unit have a remote condenser?
YES
Check high pressure safety switch. Reset if necessary
OK
Start components or compressor could be defective, see page 39
NO
Continue if machine have a remote condenser
OK
Check selector switch. Replace if defective
YES
HIGH
Check the suction pressure low or high
Pump down control possibly bad
LOW
Check refrigerant charge
OK
Liquid line solenoid valve not opening

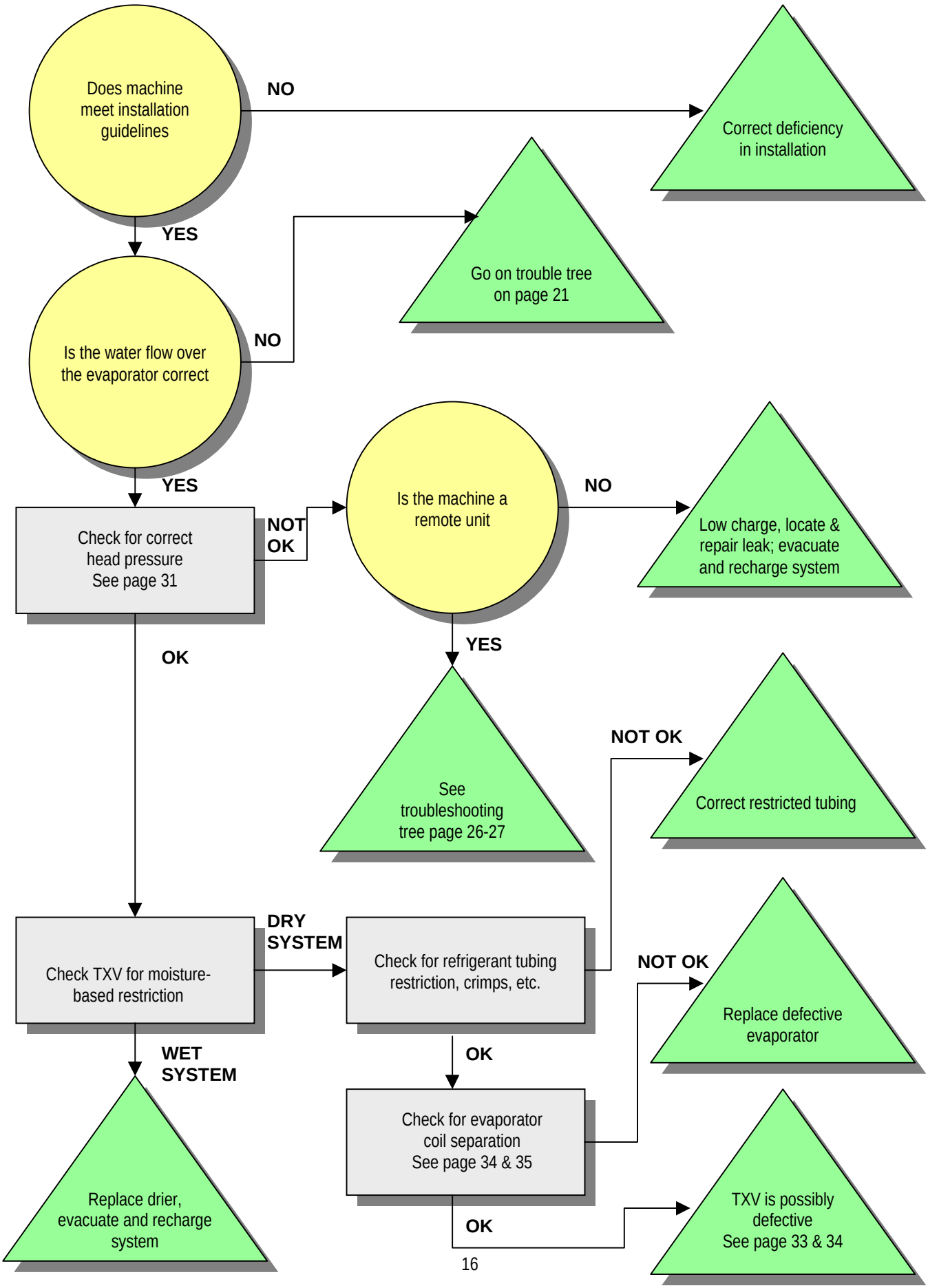
Machine Runs, Does Not Make Ice (continued)


Cont.
Is water leaking out the purge drain or water trough?
NO
Check refrigerant pressures, see page 31
HI OR NORMAL SUCTION
If head pressure is also high make sure condenser is clean and machine has good air flow
YES
LOW SUCTION
OK
Repair water leakage defect
Recover and weight in refrigerant charge
Check hot gas valve for leaking during freeze, see page 35
OK
OK
Low side restriction or defective TXV
Check for inefficient compressor

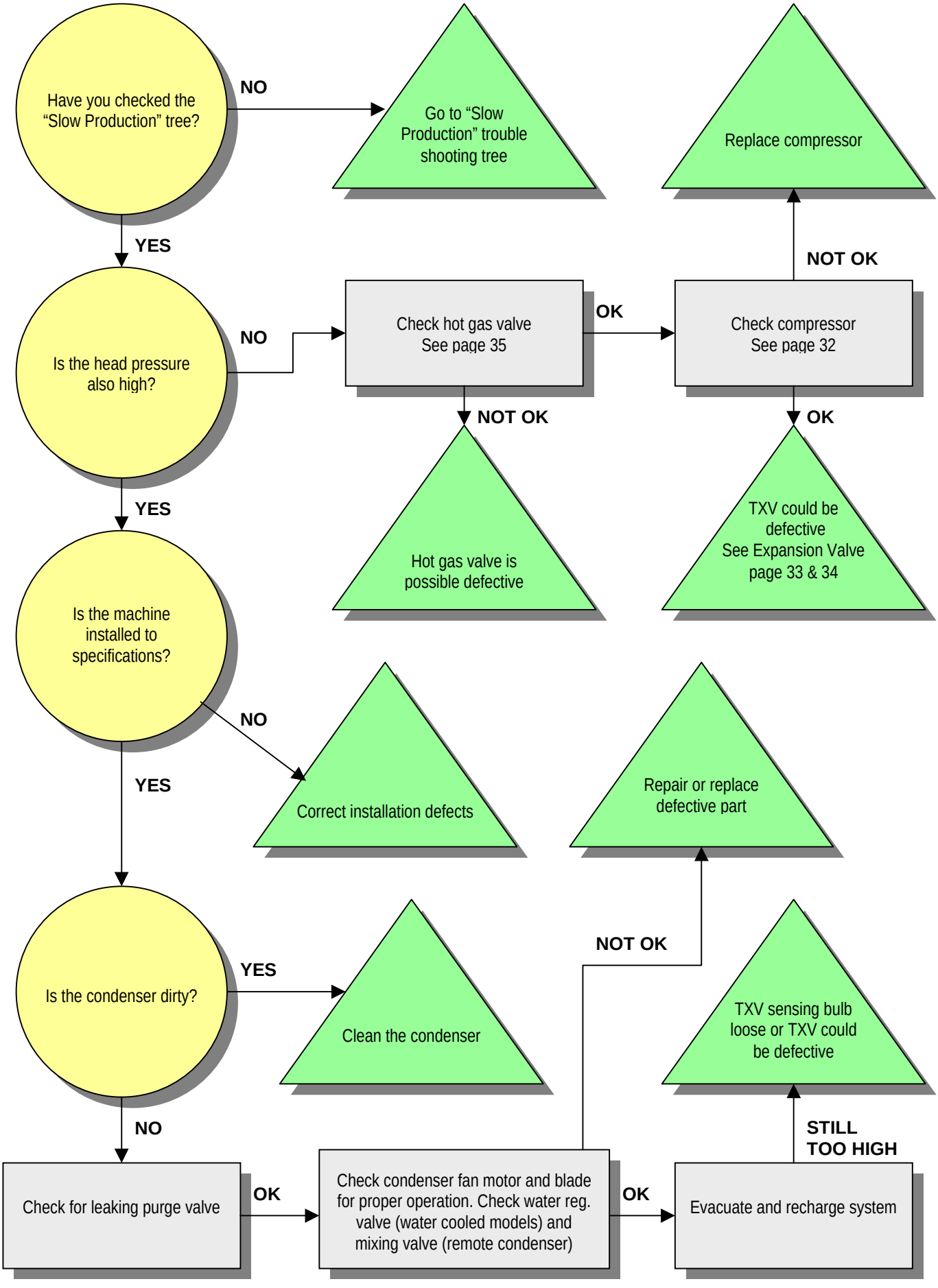
Slow Production (Cube Formation Good)



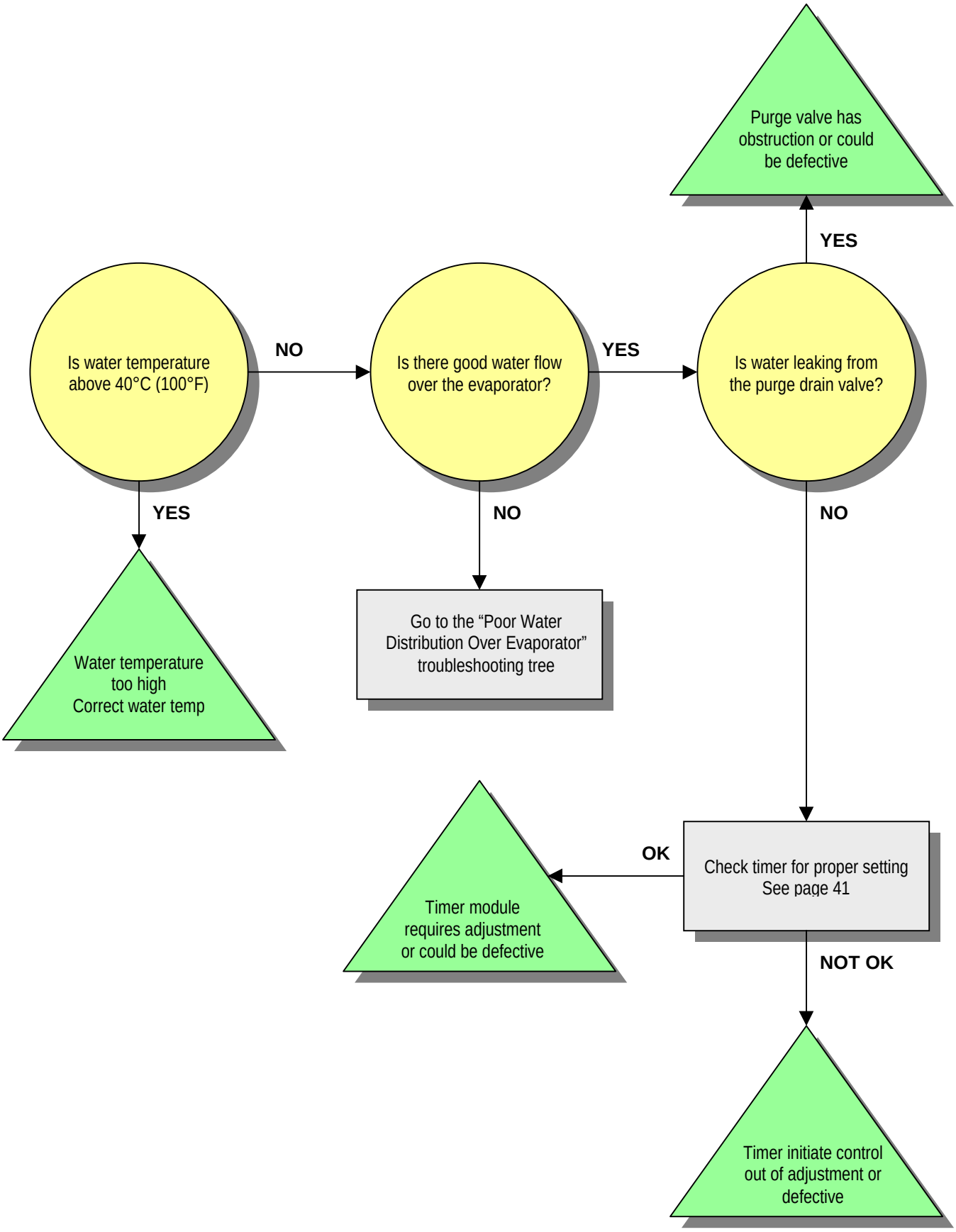
Low Suction Pressure


Does machine meet installation guidelines
NO
Correct deficiency in installation
YES
Go on trouble tree on page 21
Is the water flow over the evaporator correct
NO
YES
Is the machine a remote unit
NO
Low charge, locate & repair leak; evacuate and recharge system
Check for correct head pressure See page 31
NOT OK
YES
OK
See troubleshooting tree page 26-27
NOT OK
Correct restricted tubing
Check TXV for moisture-based restriction
DRY SYSTEM
Check for refrigerant tubing restriction, crimps, etc.
NOT OK
Replace defective evaporator
WET SYSTEM
OK
Check for evaporator coil separation See page 34 & 35
Replace drier, evacuate and recharge system
OK
TXV is possibly defective See page 33 & 34

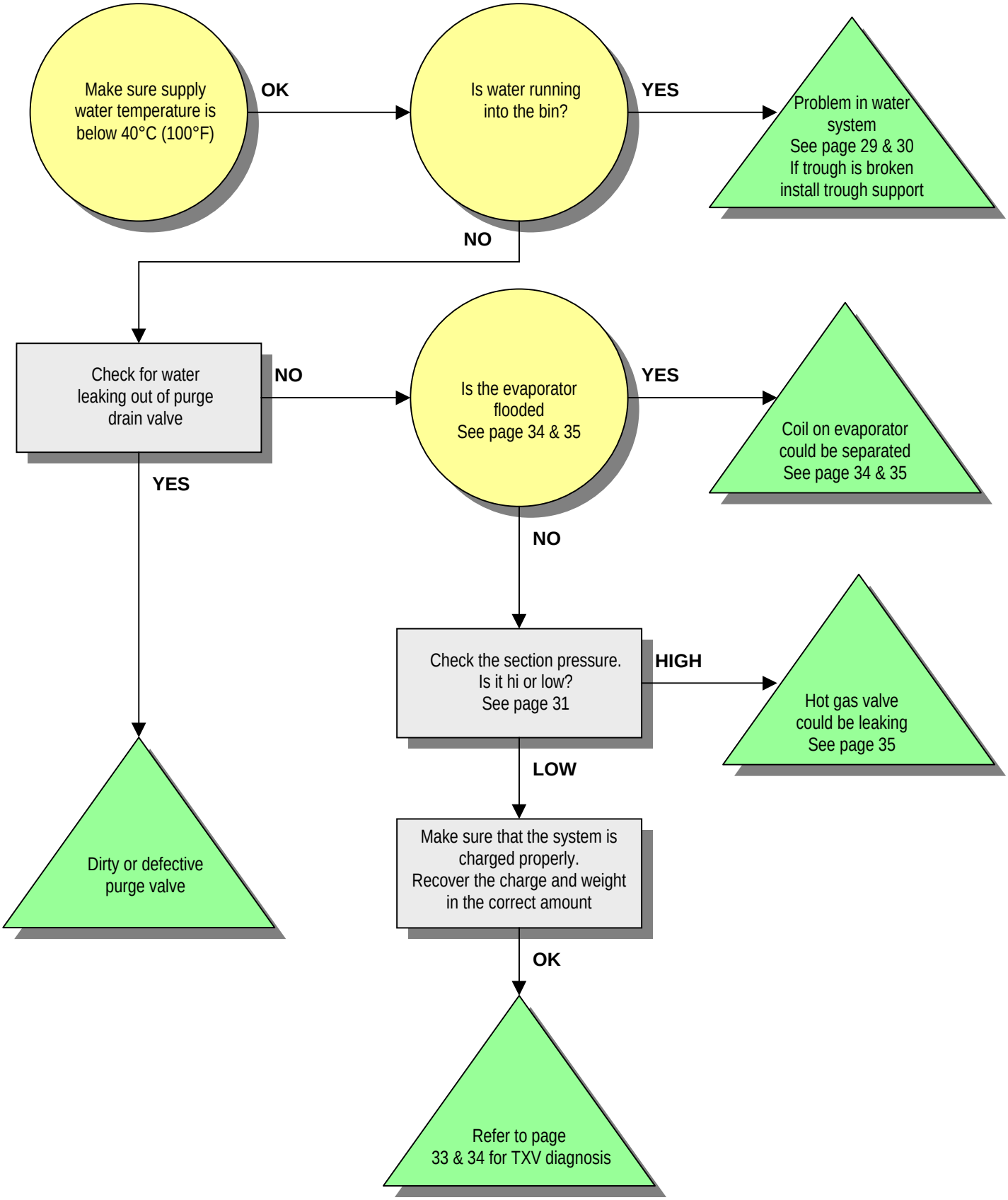
High Suction Pressure


Have you checked the "Slow Production" tree?
NO
Go to "Slow Production" trouble shooting tree
YES
Is the head pressure also high?
NO
Check hot gas valve See page 35
OK
Check compressor See page 32
NOT OK
Replace compressor
NOT OK
Hot gas valve is possible defective
OK
TXV could be defective See Expansion Valve page 33 & 34
YES
Is the machine installed to specifications?
NO
Correct installation defects
YES
Is the condenser dirty?
YES
Clean the condenser
NO
Check for leaking purge valve
OK
Check condenser fan motor and blade for proper operation. Check water reg. valve (water cooled models) and mixing valve (remote condenser)
OK
Evacuate and recharge system
STILL TOO HIGH
TXV sensing bulb loose or TXV could be defective
NOT OK
Repair or replace defective part

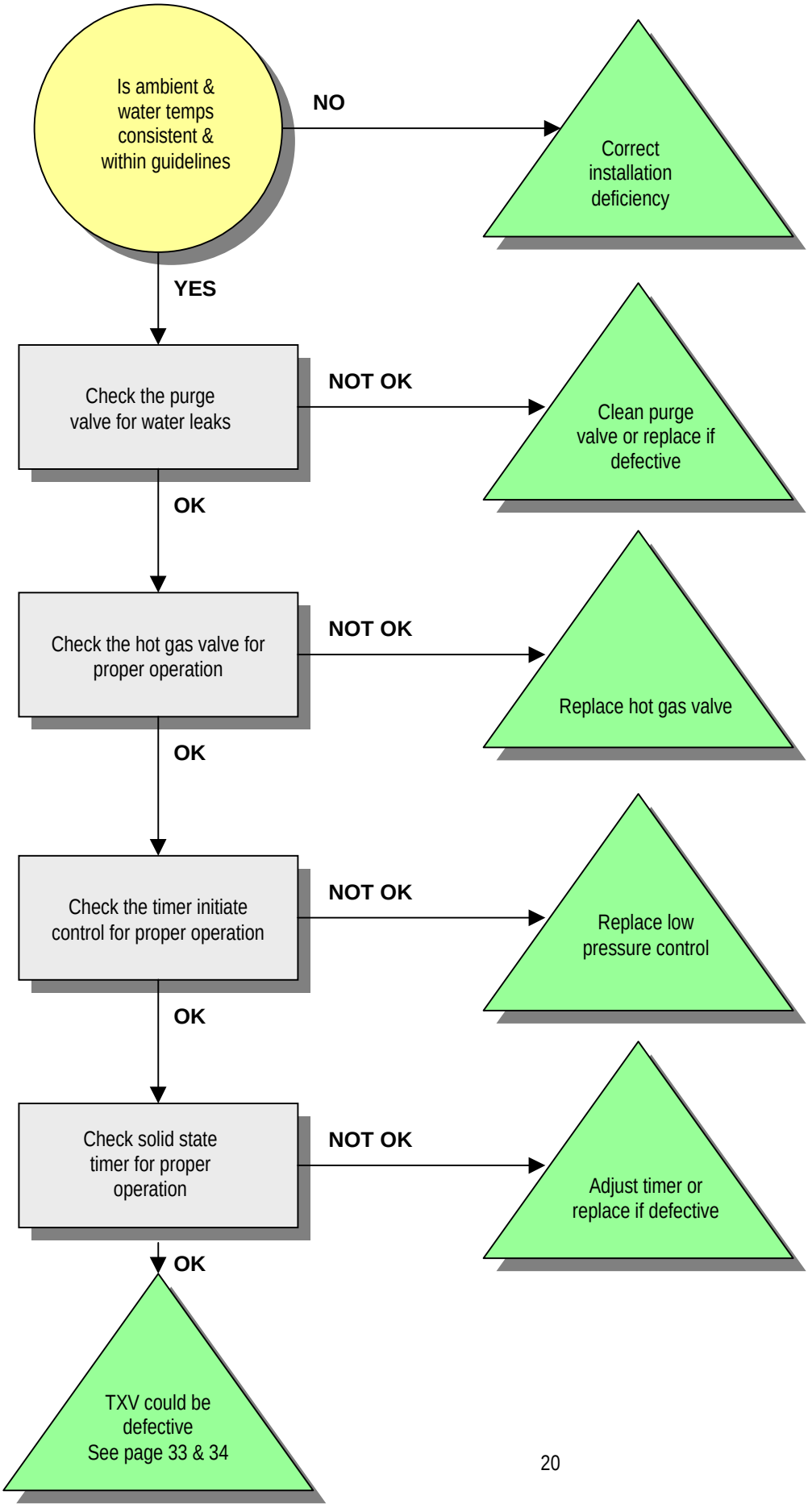
Cubes are Hollow


Purge valve has obstruction or could be defective
YES
Is water temperature above 40°C (100°F)
NO
Is there good water flow over the evaporator?
YES
Is water leaking from the purge drain valve?
YES
NO
NO
Water temperature too high Correct water temp
Go to the “Poor Water Distribution Over Evaporator” troubleshooting tree
OK
Check timer for proper setting See page 41
Timer module requires adjustment or could be defective
NOT OK
Timer initiate control out of adjustment or defective

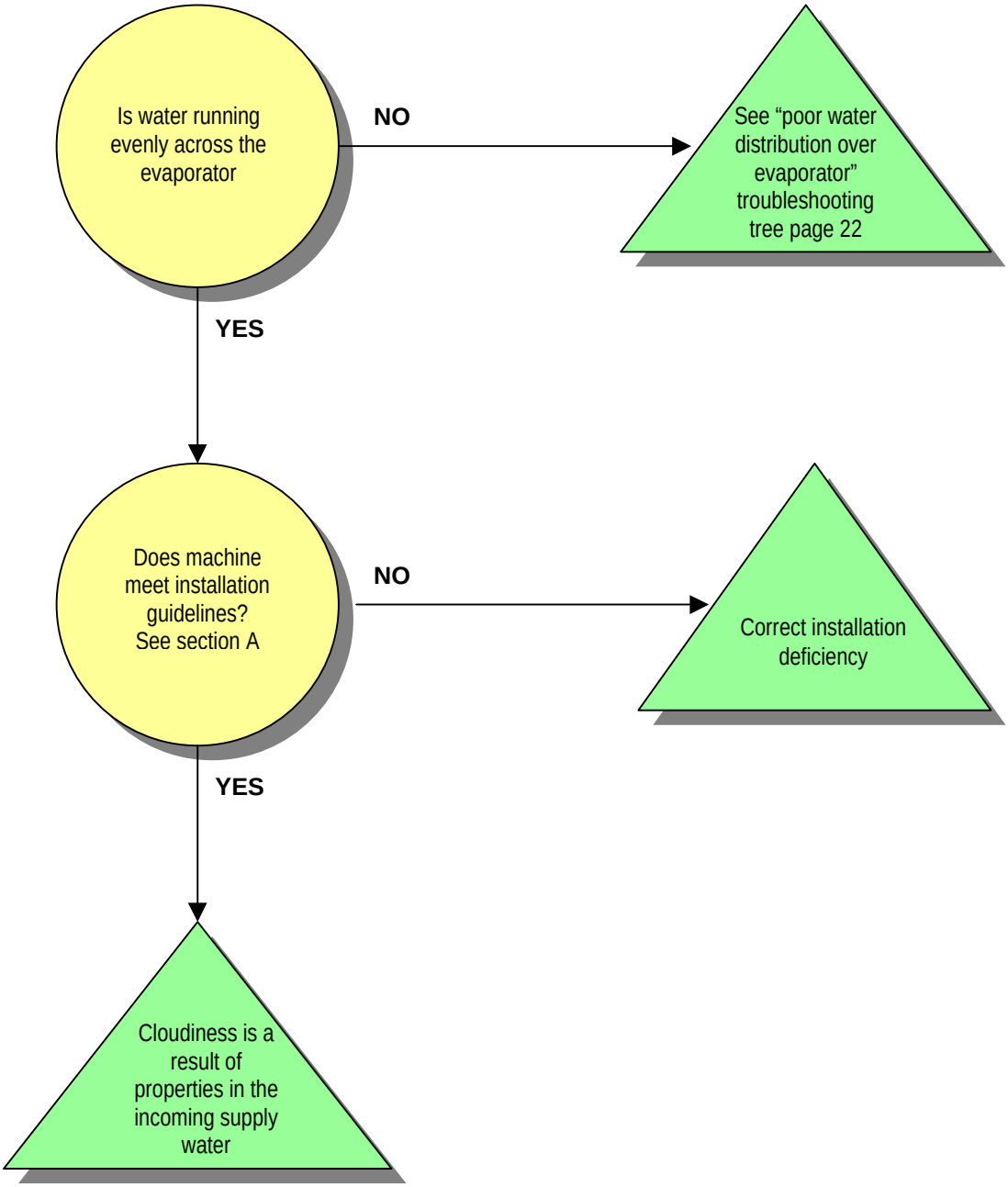
Uneven Bridge Thickness


Make sure supply water temperature is below 40°C (100°F)
OK
Is water running into the bin?
YES
Problem in water system
See page 29 & 30
If trough is broken install trough support
NO
Check for water leaking out of purge drain valve
NO
Is the evaporator flooded
See page 34 & 35
YES
Coil on evaporator could be separated
See page 34 & 35
YES
NO
Check the section pressure. Is it hi or low?
See page 31
HIGH
Hot gas valve could be leaking
See page 35
LOW
Dirty or defective purge valve
Make sure that the system is charged properly.
Recover the charge and weight in the correct amount
OK
Refer to page
33 & 34 for TXV diagnosis

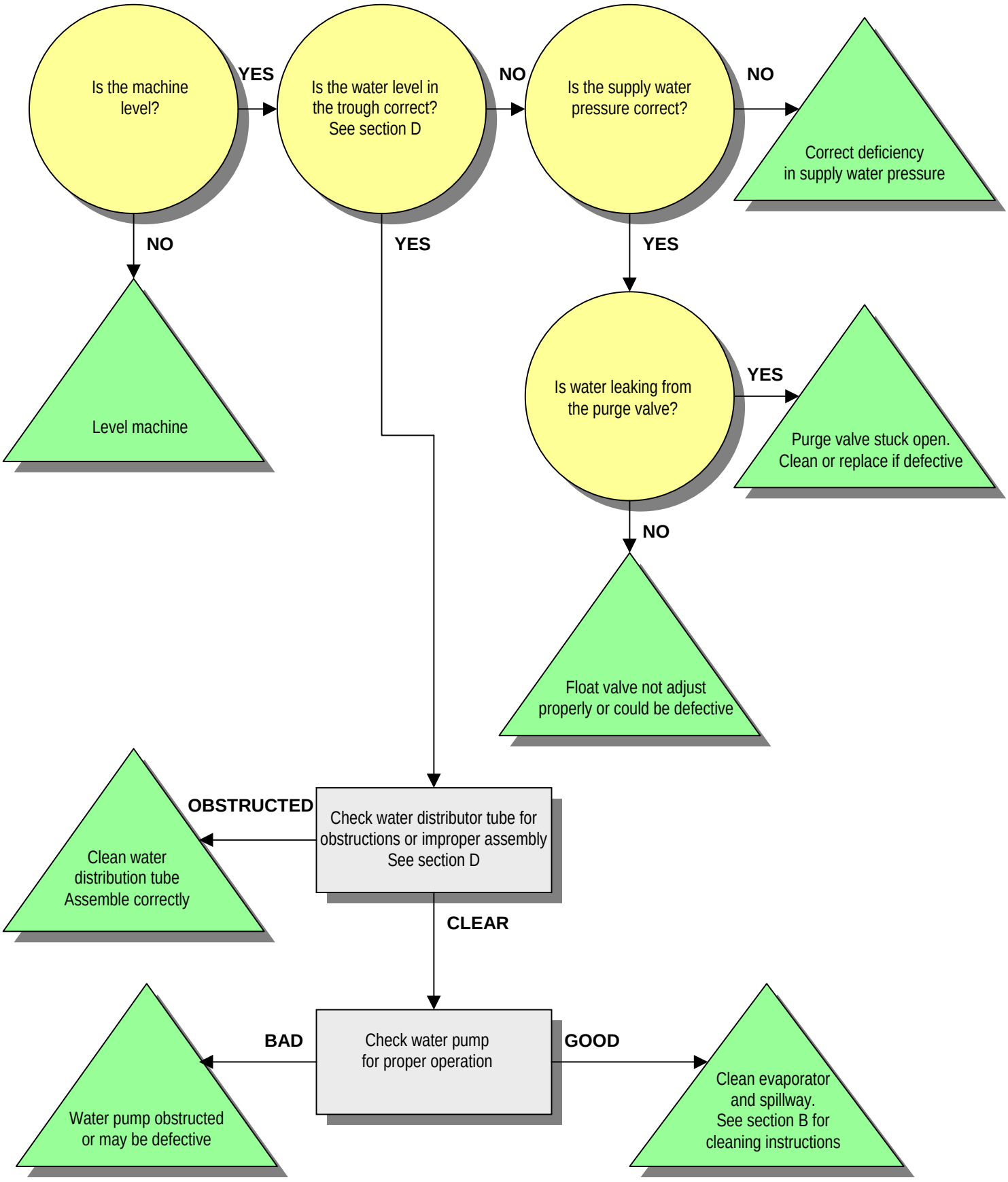
Ice Bridge Thickness Varies Cycle to Cycle



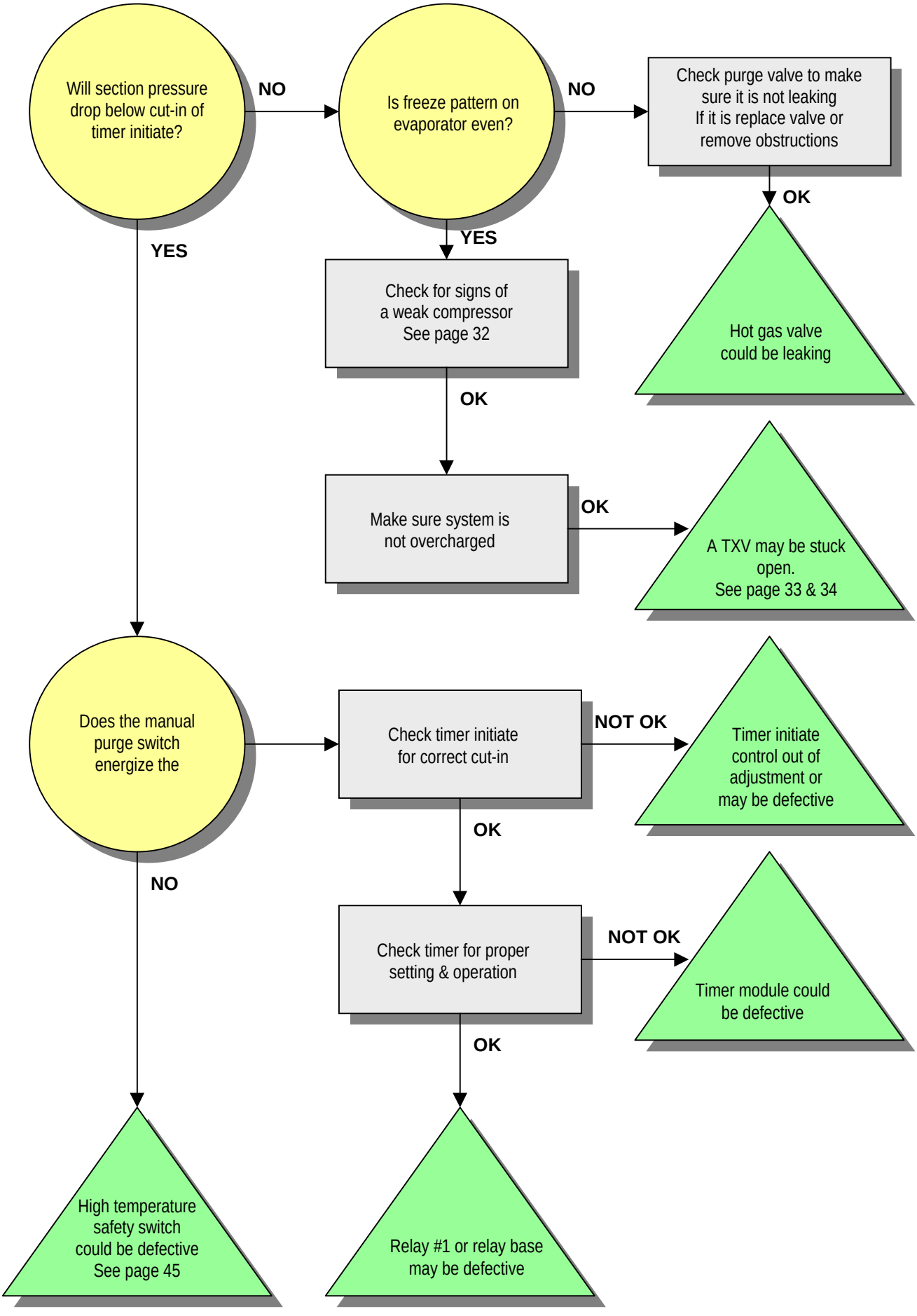
Machine Produces Cloudy Ice


Is water running evenly across the evaporator
NO
See “poor water distribution over evaporator” troubleshooting tree page 22
YES
Does machine meet installation guidelines? See section A
NO
Correct installation deficiency
YES
Cloudiness is a result of properties in the incoming supply water

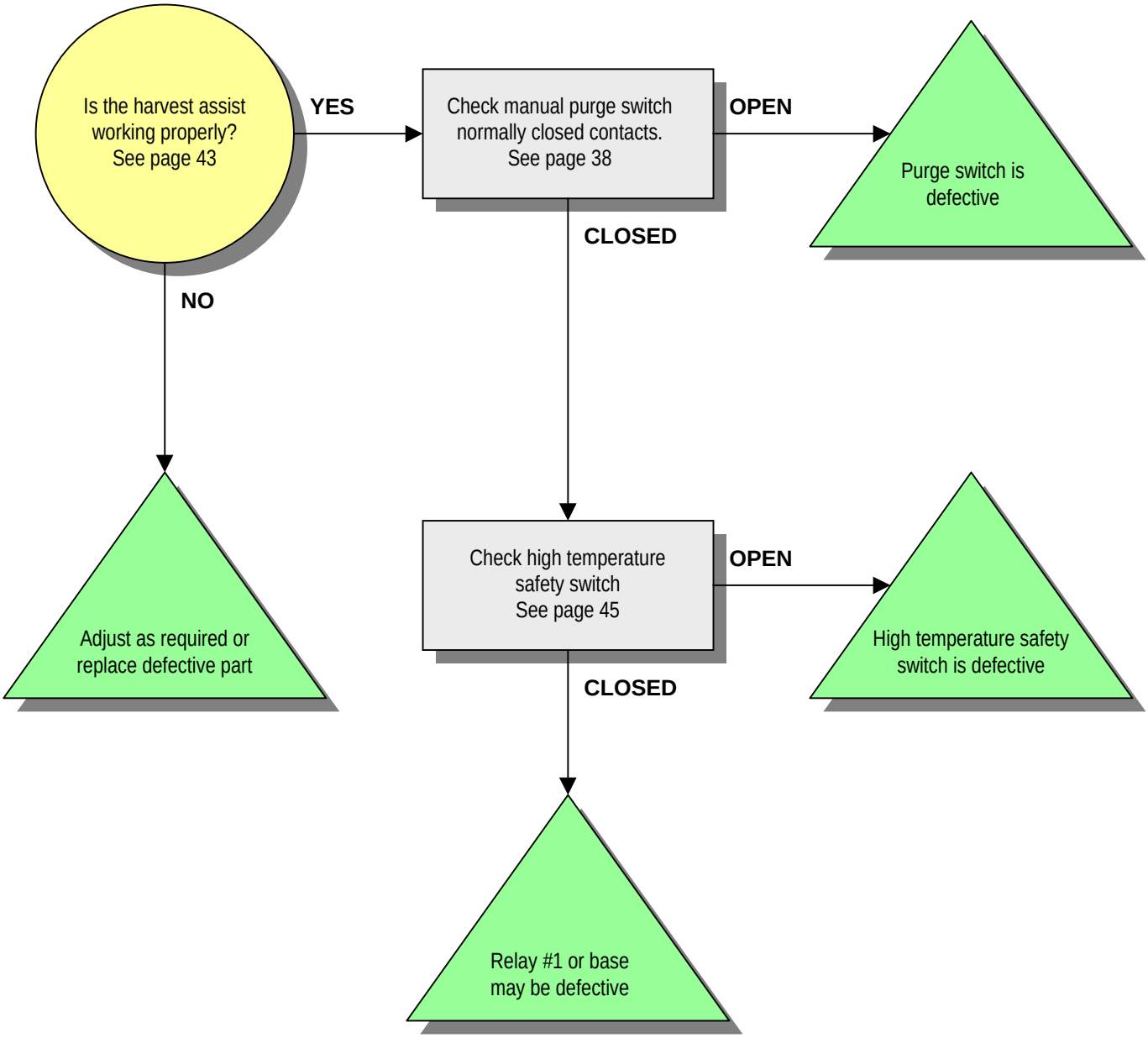
Poor Water Distribution over the Evaporator


Is the machine level?
YES
Is the water level in the trough correct? See section D
NO
Is the supply water pressure correct?
NO
Correct deficiency in supply water pressure
NO
Level machine
YES
YES
Is water leaking from the purge valve?
YES
Purge valve stuck open. Clean or replace if defective
NO
Float valve not adjust properly or could be defective
OBSTRUCTED
Check water distributor tube for obstructions or improper assembly See section D
Clean water distribution tube Assemble correctly
CLEAR
BAD
Check water pump for proper operation
GOOD
Water pump obstructed or may be defective
Clean evaporator and spillway. See section B for cleaning instructions

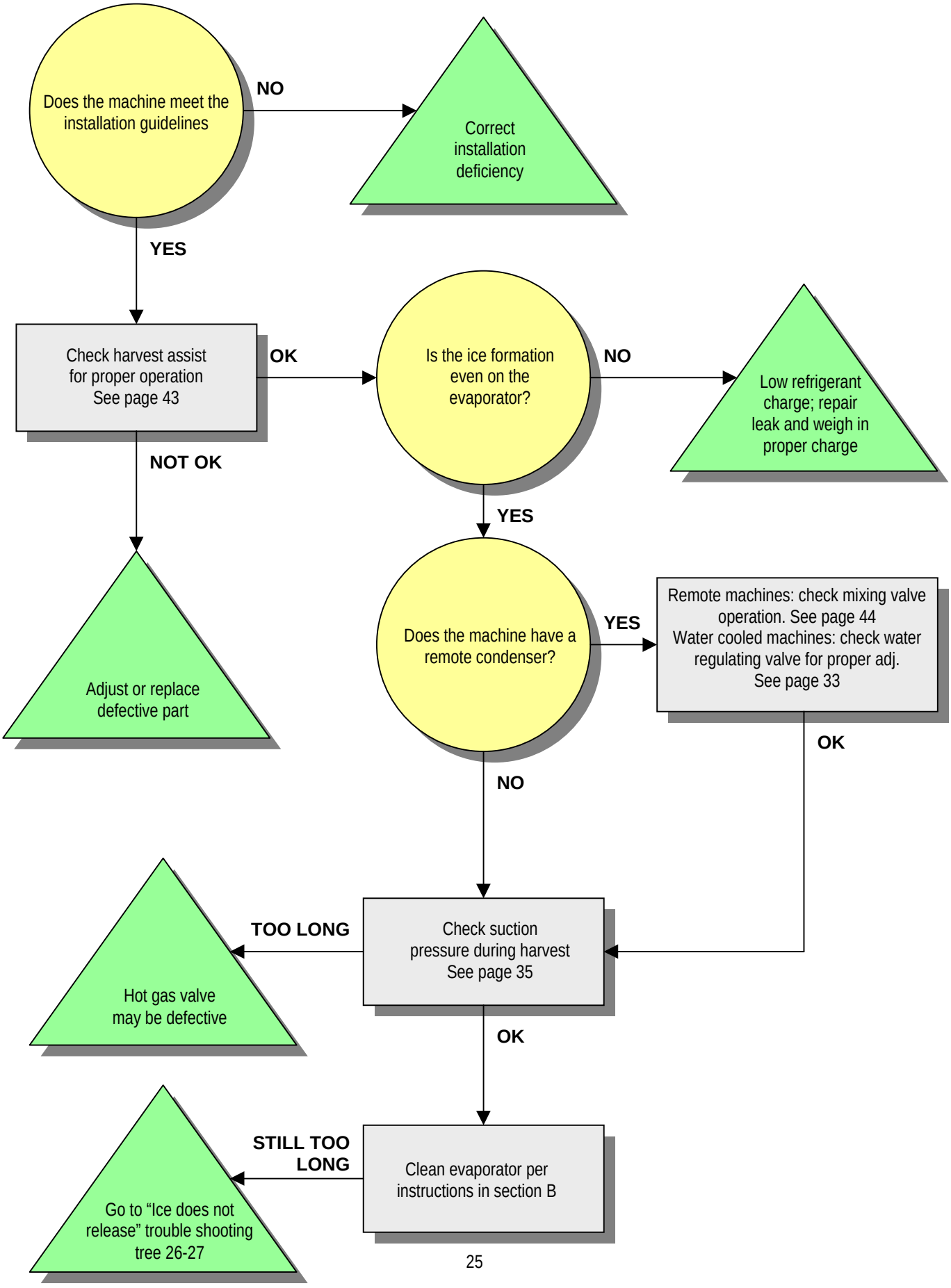
Machine Does Not Enter Harvest


Will section pressure drop below cut-in of timer initiate?
NO
Is freeze pattern on evaporator even?
NO
Check purge valve to make sure it is not leaking
If it is replace valve or remove obstructions
OK
Hot gas valve could be leaking
YES
YES
Check for signs of a weak compressor
See page 32
OK
Make sure system is not overcharged
OK
A TXV may be stuck open.
See page 33 & 34
Does the manual purge switch energize the
Check timer initiate for correct cut-in
NOT OK
Timer initiate control out of adjustment or may be defective
OK
NO
Check timer for proper setting & operation
NOT OK
Timer module could be defective
OK
High temperature safety switch could be defective
See page 45
Relay #1 or relay base may be defective

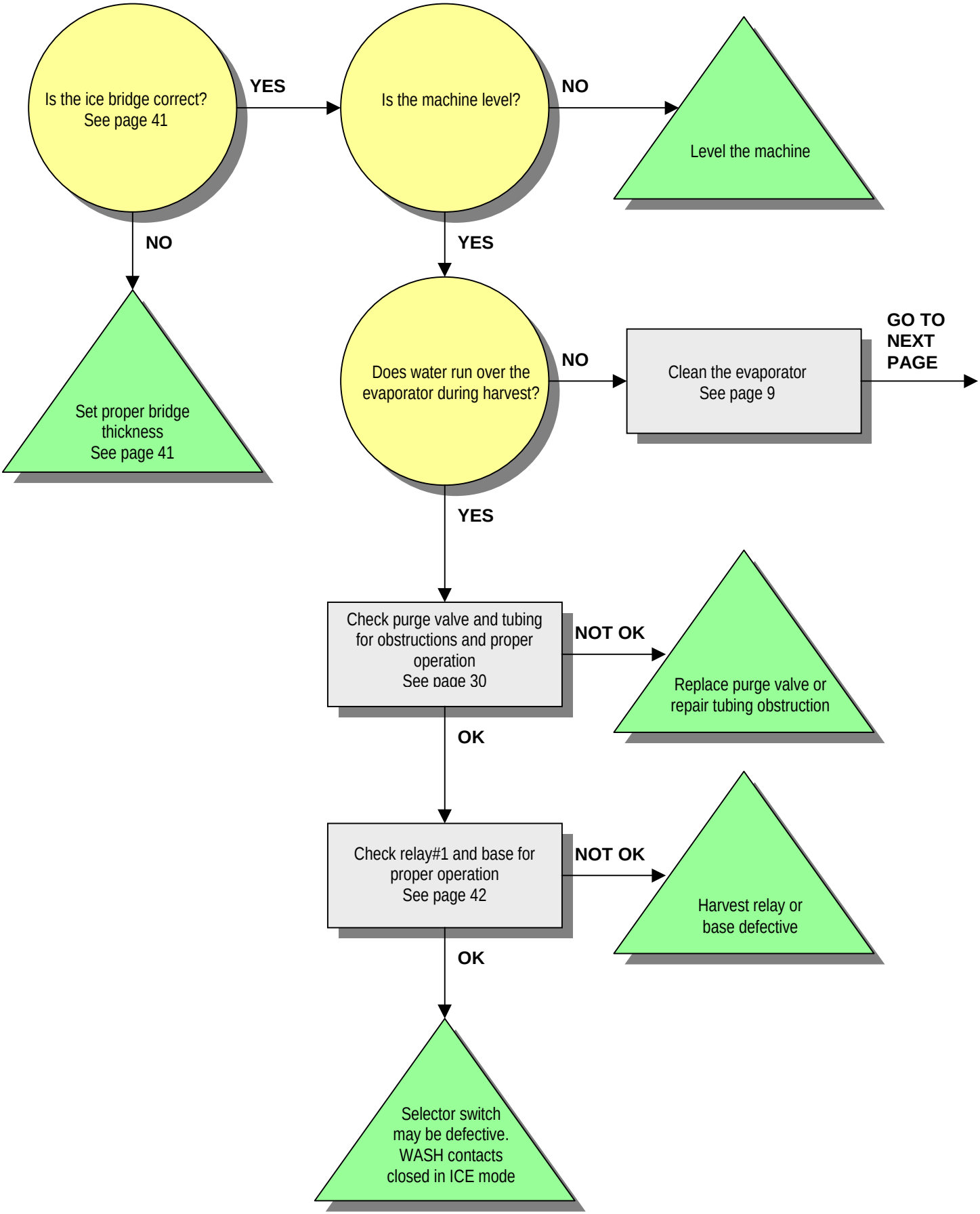
Machine Enters Harvest, Then Returns to Freeze Prematurely


Is the harvest assist working properly? See page 43
YES
Check manual purge switch normally closed contacts. See page 38
OPEN
Purge switch is defective
CLOSED
NO
Adjust as required or replace defective part
Check high temperature safety switch See page 45
OPEN
High temperature safety switch is defective
CLOSED
Relay #1 or base may be defective

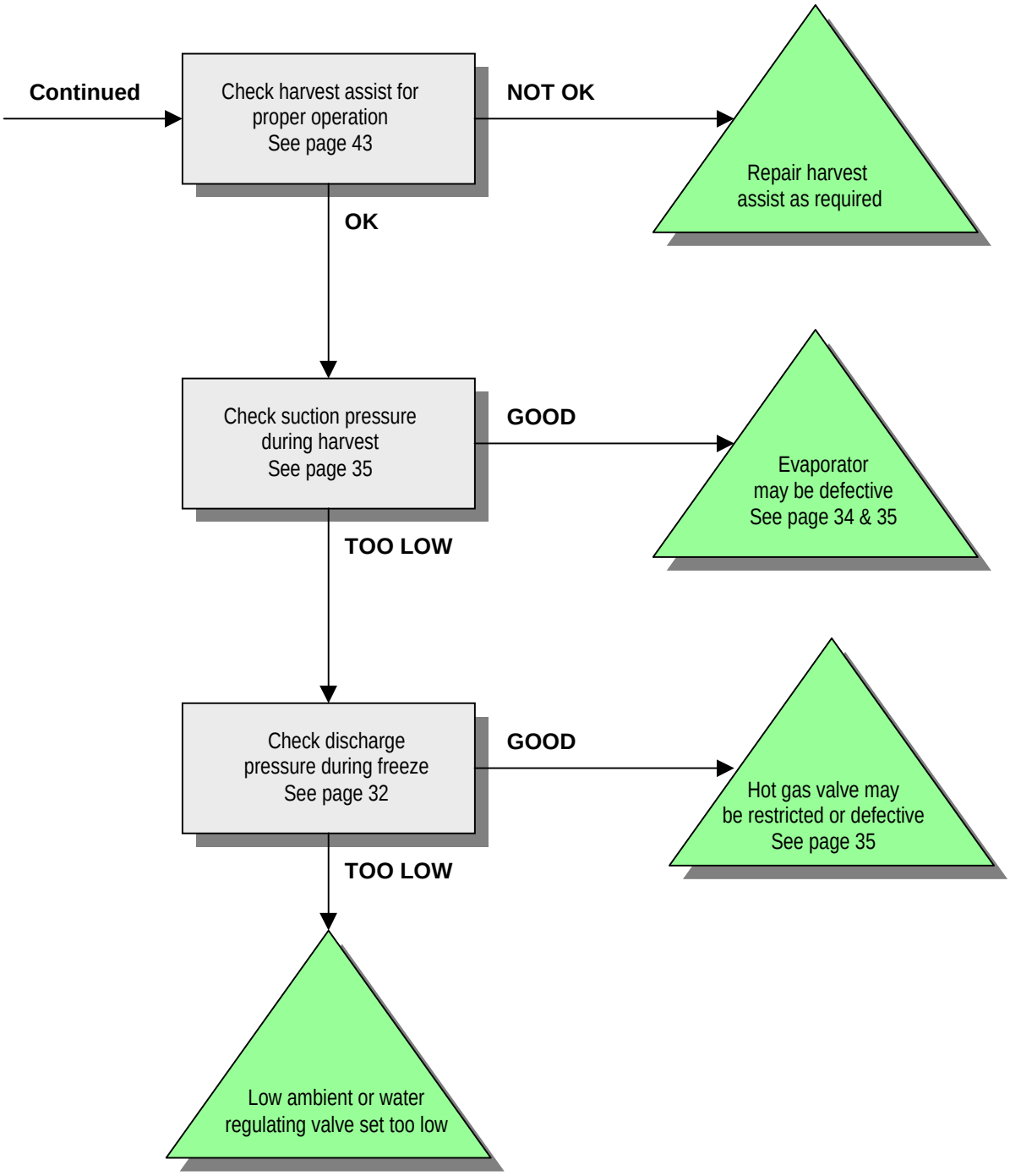
Length of Harvest Excessive


Does the machine meet the installation guidelines
NO
Correct installation deficiency
YES
Check harvest assist for proper operation See page 43
OK
Is the ice formation even on the evaporator?
NO
Low refrigerant charge; repair leak and weigh in proper charge
NOT OK
YES
Adjust or replace defective part
Does the machine have a remote condenser?
YES
Remote machines: check mixing valve operation. See page 44
Water cooled machines: check water regulating valve for proper adj. See page 33
OK
NO
TOO LONG
Hot gas valve may be defective
Check suction pressure during harvest See page 35
OK
STILL TOO LONG
Go to "Ice does not release" trouble shooting tree 26-27
Clean evaporator per instructions in section B

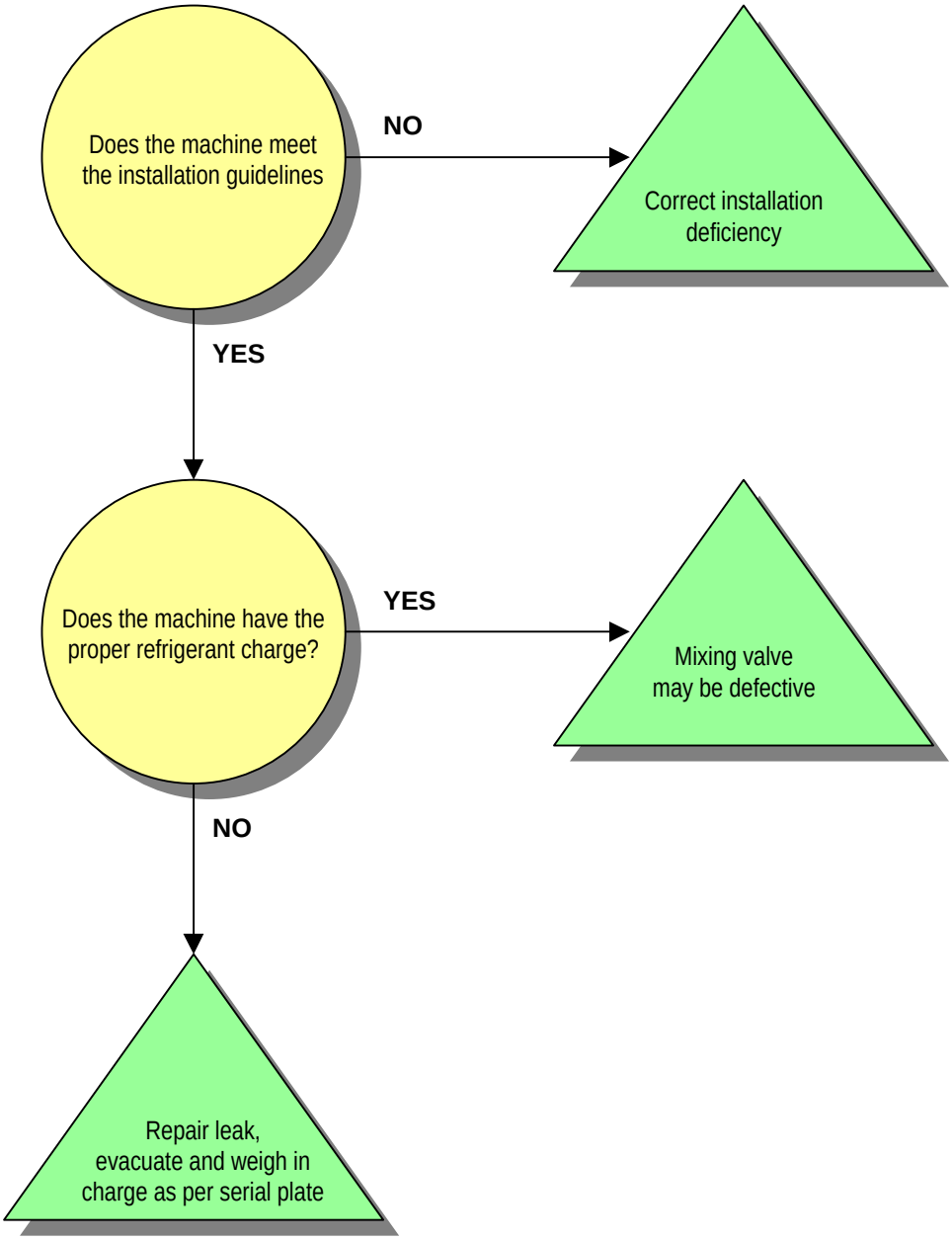
Ice Does Not Release From Evaporator

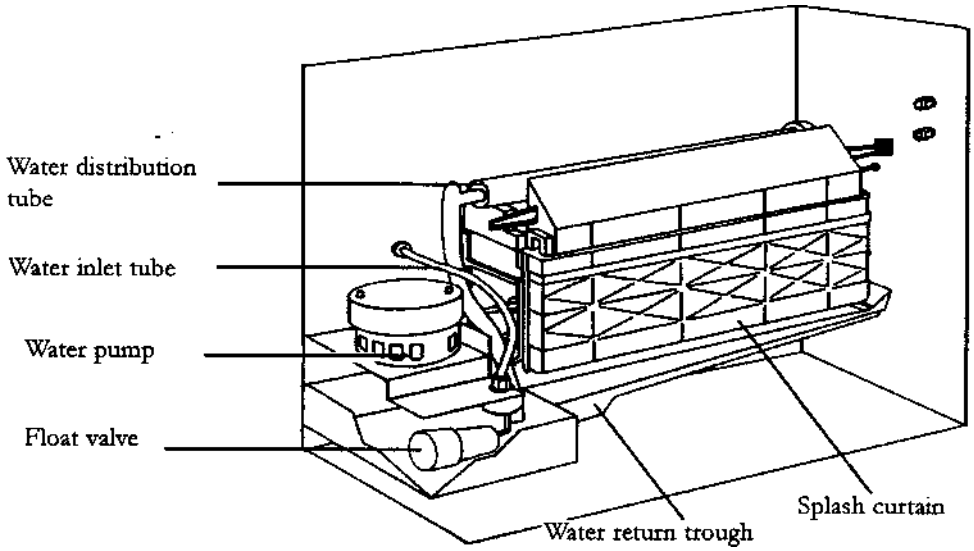


Ice Does Not Release From Evaporator (continued)


Continued
Check harvest assist for proper operation See page 43
NOT OK
Repair harvest assist as required
OK
Check suction pressure during harvest See page 35
GOOD
Evaporator may be defective See page 34 & 35
TOO LOW
Check discharge pressure during freeze See page 32
GOOD
Hot gas valve may be restricted or defective See page 35
TOO LOW
Low ambient or water regulating valve set too low

Hot Evaporator, Low Suction and Discharge Pressures


Does the machine meet the installation guidelines
NO
Correct installation deficiency
YES
Does the machine have the proper refrigerant charge?
YES
Mixing valve may be defective
NO
Repair leak, evacuate and weigh in charge as per serial plate



MV 100 Series Machine Shown

Water Distribution and Components

Water enters the machine through the **float valve** located in the **water trough**. The water trough holds water used for ice making. The float valve is used to maintain the proper water level in the water trough. During the freeze cycle water is continuously circulated over the evaporator by the **water pump**. When the machine enters harvest, the **purge valve (not shown)** opens and mineral laden water is pumped out of the water trough to the drain. After water is purged from the trough the water pump and purge valve are de-energized and the trough refills.

Note: The water trough requires a support bracket *to* prevent breakage of the water trough on single evaporator models. Brackets can be ordered far alder machines that w ere manufactured without them.

Float Valve

The water level can be adjusted by carefully bending the arm of the float. The water level should be 1.25 cm (1/2") above the top of the water pump impeller housing during the freeze cycle.

If the float valve does not allow water into the trough or water flow is slow, the float valve may be restricted. Remove and disassemble the float valve and clean the orifice. If water flow is still slow check the water pressure to be sure it is at least 1.5 bar (20psi).

If the float valve does not stop the water flow make sure the water pressure to the machine does not exceed 4 bar (60 psi). Install a water pressure regulator if pressure is too high. If the water pressure is not the problem, the float seal or the entire float valve assembly should be cleaned or replaced

Water Distribution Tube

Water is pumped to a distribution tube located at the top of the evaporator. The water distribution tube is used to distribute water evenly over the evaporator. The distribution tube can be removed and disassembled for cleaning if the holes become plugged or if there is excessive mineral up in the water system. The water distribution tube is a tube within a tube. Water first enters and fills the inner tube and exits through a series of holes along the top of the tube. Water fills the outer tube and exits through a series of holes along the bottom of the tube. For proper water f1ow over the evaporator it is important that the tube be assembled correctly after cleaning. The tube can be checked for proper assembly by checking the bump on the f1ange at the ends of the tube, the bump should be on top. See drawing below

Water Distribution Tube Disassembly

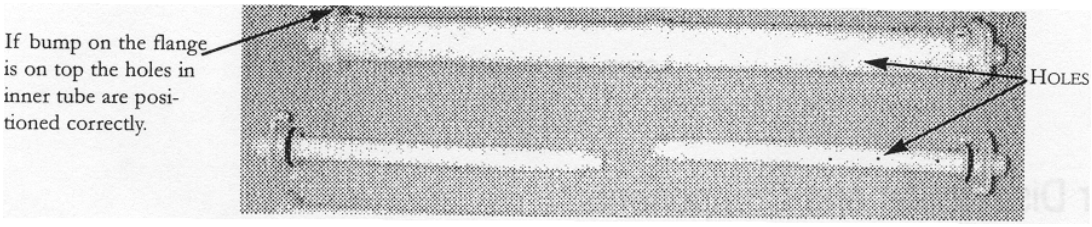
Remove 2 screws holding the distribution tube to the evaporator spillway. Remove the clamp holding the water tube to the distribution tube. Twist the end caps of the distribution tube C.C.W and pull to remove inner tubes halves from outer tube. To reassemble push the inner tube halves into outer tube with all holes facing the same direction. Make sure that inner tube halves seat together completely. Twist end caps C.W 1/2 turn to lock inner tubes in place. Holes in tubes will now be facing opposite directions.

Important:

For proper water flow over the evaporator the holes on the inner tube must be facing upward.

OUTER TUBE

SHOWN WITH INNER TUBE IN PLACE



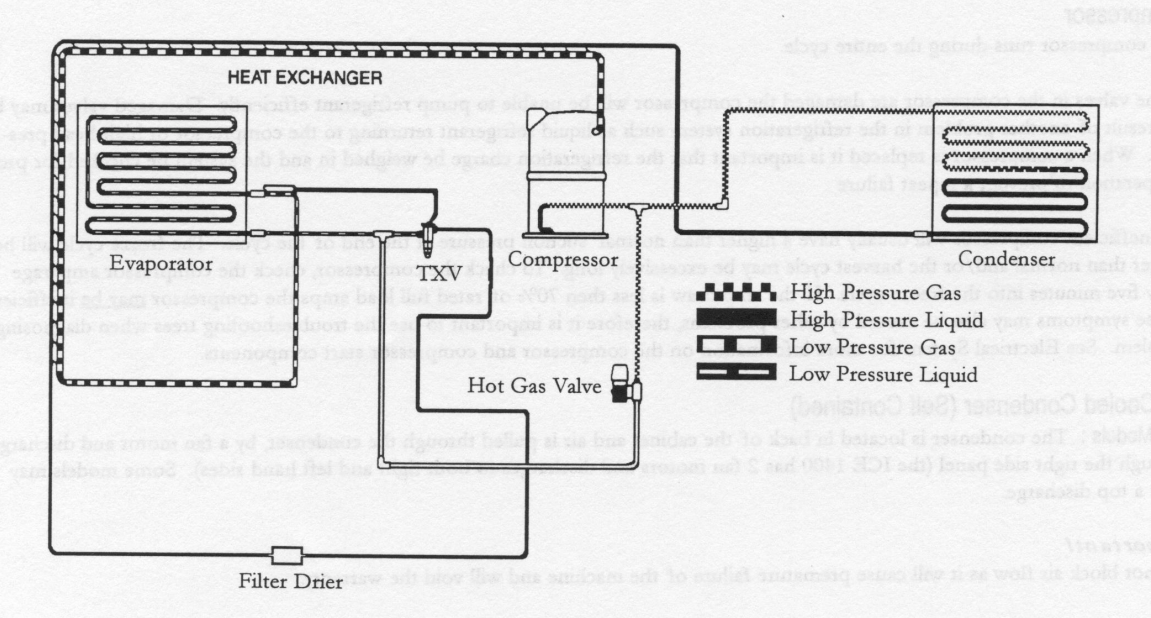
INNER TUBE

- Splash Curtain
- A splash curtain covers the evaporator to prevent water from splashing into the bin. The splash curtain is also used to actuate the bin switch. When the bin becomes full of ice, the splash curtain is held open when the ice drops off the evaporator. The actuator tab of the splash curtain releases pressure on the bin switch and the machine shuts off. See bin control on page 46. On single evaporator units, if the splash curtain is removed or opened during the freeze cycle the machine will continue to run until the ice drops from the evaporator. On dual evaporator units, if the curtain is removed during the untimed portion of the freeze cycle, or during defrost, the unit will shut down. If it is removed during the timed freeze cycle, the unit will continue to operate.
- The splash curtain can be removed by swinging the bottom of the curtain away from the evaporator. Lift the right side of the curtain up and out of the hinge pin slot. To reinstall the curtain, position the left side pin into the slot first, then insert the right hand side with the ear of the curtain behind the bin switch.

- Purge Valve
- When the machine enters the harvest cycle the water pump continues to run and the purge valve opens. This al1ows mineral laden water to be pumped from the trough to the drain. This helps keep the water system clean. The water pump and purge valve de-energize once water is flushed from the trough. The length of time that the water pump and purge valve remain energized is con- trolled by the cam switch, see page 43. The purge valve can also be energized manual1y by pushing the purge switch. The purge switch is used when cleaning the water system to flush cleaning solution down the drain. See page **8** for cleaning instructions.

- The purge valve must be completely closed during the freeze cycle. If water leaks through the purge valve during freeze the freeze time will be extended and poor ice formation will result. The valve may be defective or need cleaning. The purge valve can be disassembled by: a) Disconnect power from the unit. b) Lift and slide the coil retainer cap from the top of the coil. c) Leaving the wires attached, note the position of the coil assembly on the valve body then lift the coil assembly off the valve body. Make sure to properly align the coil assembly when reassembling the valve body. d) Press the enclosing tube's plastic nut down and rotate it 1/4 turn. Remove the enclosing tube, plunger and diaphragm from the valve body.

- *Note:* The purge valve can be easily cleaned or rebuilt without removing the entire valve body. Dirty or clogged purge valves are not considered a warranty repair.



Refrigeration Cycle and Components

Before diagnosing the refrigeration system, it is very important that refrigerant charge be correct. Whenever the refrigeration system has been opened, the filter-drier must be replaced and the proper refrigerant charge must be weighed in. See refrigerant charge information on page 4 through 5.

Refrigerant Pressures

At the beginning of the freeze cycle the suction pressure should be approximately 4 bar (60 psi). The pressure at the beginning of freeze may be up to 0.7 bar (10 psi.) less then those stated, depending on operating conditions. Pressures less than this may indicate an under charge. With proper ice bridge thickness, the suction pressure at the end of the freeze cycle is approx. 1.7-1.9 bar (24 to 28 psi) (varies with each machine). This pressure may also vary with operating conditions. The head pressure on water cooled units should be adjusted to 17 bar (250 psi). Discharge pressure on air cooled units will vary with ambient conditions but will typically run higher than water cooled units. Remote condensers located in ambient temperatures below 21°C (70°F) will typically run a lower head pressure. See Mixing Valve later in this section.

Refrigerant is pumped throughout the refrigeration system by a hermetic compressor. Refrigerant, in its gas state is pumped from the compressor to the condenser. Heat is removed from the refrigerant either by forced air movement through the condenser or by a heat exchanger (water cooled condenser) that transfers heat from the refrigerant to water. The refrigerant changes to a liquid when cooled.

The refrigerant in a liquid state passes through a filter drier. The filter drier traps small amounts of moisture and foreign particles from the system.

Important:

The filter drier must be rep1aced whenever the refrigeration system is opened or if the refrigerant charge has been completely lost.

Compressor

The compressor runs during the entire cycle.

If the valves in the compressor are damaged the compressor will be unable to pump refrigerant efficiently. Damaged valves may be the result of another problem in the refrigeration system such as liquid refrigerant returning to the compressor or high head pressure. When a compressor is replaced it is important that the refrigeration charge be weighed in and the system be checked for proper operation to prevent a repeat failure

An inefficient compressor will usually have a higher than normal suction pressure at the end of the cycle. The freeze cycle will be longer than normal and/ or the harvest cycle may be excessively long. To check the compressor, check the compressor amperage draw five minutes into the freeze cycle. If the amp draw is less then 70% of rated full load amps the compressor may be inefficient. These symptoms may also be caused by other problems, therefore it is important to use the troubleshooting trees when diagnosing a problem. See Electrical System for more information on the compressor and compressor start components.

Water Cooled Condenser

If the machine has been install properly, the water flow through the condenser will be in a direction opposite the refrigerant flow The water supply must be between 1.5 bar (20 psi) and 4 bar (60 psi) of pressure to the condenser. The inlet water temperature must not exceed 40°C (100°F). A water regulating valve is used to control the flow of water into the condenser. In areas that have poor water quality the condenser may eventually become coated with mineral deposits. This will decrease the efficiency of the con- denser resulting in high head pressure. Water cooled condensers replaced because of failure due to excessive mineral build up will not be covered under warranty.

Water Regulating Valve

The water regulating valve controls the head pressure by regulating the amount of water flow through the condenser. The bellows of the regulating valve are connected to the high side of the system. As the head pressure rises, the bellows expand increasing the water flow through the condenser. The rate of water flow can be changed by adjusting the spring pressure screw at the top of the valve. The valve should be adjusted to maintain a head pressure of 17.5 bar (250 psi). Water exiting the condenser should be between 40°C (100°F) and 43°C (110°F). When the machine is off, the water regulating valve will close completely stopping the flow of water through the condenser. If the water flow does not stop when the machine is off the valve should be replaced.

Air Cooled Condenser (Remote)

See pages 35 and 37.

High Pressure Safety

If the head pressure becomes too high the **High Pressure Safety** will open and the machine will shut off. The high pressure safety opens at 31 bar (450 psi). Note: The high pressure safety is used on all water cooled and remote machines and some self-contained air cooled machines.

Thermostatic Expansion Valve

The thermostatic expansion valve meters the flow of refrigerant into the evaporator changing its state from a high pressure liquid to a low pressure liquid. This drop in pressure causes the refrigerant to cool. The cooled refrigerant absorbs heat from the water circulating over the evaporator. As the evaporator fills with liquid refrigerant the evaporator becomes colder.

The flow of refrigerant into the evaporator is controlled by the temperature at the outlet of the evaporator. The expansion valve bulb, which is mounted to the top of the suction line, senses the evaporator outlet temperature causing the valve to open or close. As ice forms on the evaporator the temperature drops and the flow of refrigerant into the evaporator decreases. This causes the suction pressure to drop.

Thermostatic Expansion Valve Diagnosis

The evaporator should become completely flooded (filled with liquid refrigerant) during the freeze cycle. A completely flooded evaporator will have a uniform freeze pattern (ice formation across the evaporator). A starved evaporator (not enough liquid refrigerant) will have poor or no ice formation at the top of the evaporator, and the tubes(s) exiting the evaporator will not frost. All tubes should be frosted within approximately 5 minutes from the start of the freeze cycle. An expansion valve that is restricted or not opening properly will starve the evaporator causing the suction pressure to be lower than normal. A low refrigerant charge will also starve the evaporator and cause low suction and head pressures. If not sure of the amount of charge in the system the refrigerant should be recovered and the correct charge weighed in before a defective valve can be diagnosed. If the evaporator is starved but the suction pressure is higher than normal the TXV is not the problem, refer to the troubleshooting trees in section C.

If the T.X.V. sticks open or if the sensing bulb is not making good contact with the suction line, the flow of refrigerant into the evaporator will be too great and liquid refrigerant will flood the compressor. The suction pressure will remain higher then normal and the machine will remain in an extended freeze cycle. Ice will build evenly but will become very thick.

Symptom	**Problem**	**Remedy**
1. Evaporator flooded but suction pressure not dropping. Compressor has been checked and appears to be good. Suction line at compressor may be colder then normal.	a. TXV sensing bulb not making good contact with suction line or uninsulated. b. TXV sensing bulb in wrong location. c. System overcharged. d. TXV stuck open	a. Clean suction line and clamp bulb securely Insulated bulb. b. Relocate sensing bulb to top of suction line. c. Recover refrigerant and weigh in correct charge d. Replace T.X.V.
2. Evaporator starved, no frost on line(s) exiting evaporator. Suction pressure is low See Evap. diagram on page 35.	a. Machine is low charged. h. TXV restricted or sticking closed	a. Recover refrigerant and weigh in proper charge. b. Relace TXV and filter drier. Once valve has been removed check valve for moisture.

A dual evaporator machine will have one TXV for each evaporator. If one TXV sticks open and the other is operating normally, the suction pressure will be higher than normal and both evaporators will build thick ice. It is recommended that both valves be replaced if one sticks open.

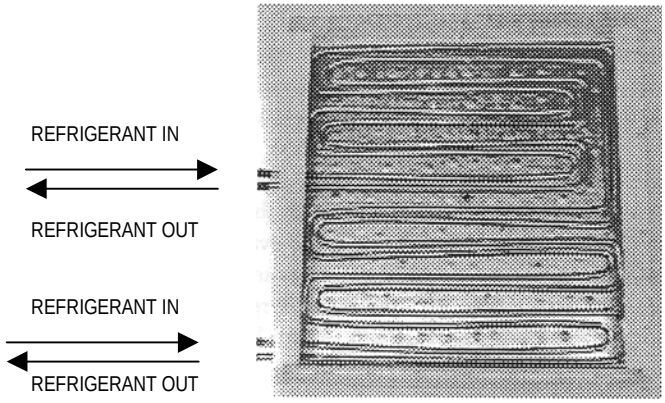
If one TXV sticks closed and one is operating normally the suction pressure will be normal or low but the evaporator with the defective valve will be starved (thick ice at the bottom and thick ice at the top).

Evaporator

As water is circulated over the front of the evaporator, liquid refrigerant is circulated through the tubing attached to the back of the evaporator. As the liquid refrigerant in the tubing vaporises it absorbs heat from the water, causing it to freeze. The evaporator should be completely flooded throughout most of the freeze cycle. A flooded evaporator will build ice evenly across the evaporator. The top row will usually be slightly thinner then the rest of the evaporator. A starved evaporator will have thick ice at the bottom and thin ice at the top. Most problems with ice formation or harvesting are not related to a defective evaporator, use the Troubleshooting Trees in section C for additional help in diagnosis.

Note: The MV 100 will have a slight variance in ice thickness from top to bottom.

Refrigerant enters the evaporator through the bottom tube and exits through the top tube. The refrigerant line at the outlet of the TXV splits into two feeder tubes. This split occurs at the distributor which is a fitting that is soldered to the TXV. One feeder tube from the distributor feeds the top of the evaporator, the other tube feeds the bottom of the evaporator. The evaporator tubes run parallel, in opposite directions, along the back of the evaporator creating a dual pass. See diagram below:



DUAL PASS EVAPORATOR

If the evaporator is flooded but is not building ice evenly it is possible that the evaporator has coil separation. Evaporator coil separation is the separation of the refrigerant tubing from the back of the evaporator plate. This is very rare but occurs from time to time. Usually, all of the following symptoms will be present.

1. Low suction pressure.
2. Ice not releasing from the evaporator during harvest.
3. Hollow cubes or uneven ice bridge on some areas of the evaporator.

If coil separation is suspected let the machine run in freeze until the timer has energized. Now check the evaporator for areas where cubes are less developed than the cubes in other areas. If the cubes are all the same size, coil separation is not the problem. If there are areas other than the top row with less developed cubes, check the refrigerant lines at the inlet(s) and outlet(s) of the evaporator, if both lines are frosted the coil is separated. To confirm coil separation remove and check the back of the evaporator. If the coil is separated the evaporator must be replaced. If the outlet(s) of the evaporator is not frosted the problem is not with coil separation (refer to the troubleshooting trees, section C).

Note: **Permanent discoloration on the evaporator plating is normal and will cause no problems with harvesting the ice or with sanitary conditions. Before condemning the evaporator for plating problems be certain it is not just discoloration. Good evaporators will not be covered under warranty.**

Note: If the spillway (white plastic evaporator top) becomes damaged it can be replaced. It is not necessary to replace the entire evaporator.

As the liquid refrigerant leaves the evaporator it changes to a low pressure gas before returning to the compressor.

Important!
Liquid refrigerant must not return to the compressor, compressor damage will result. Frost on the suction line at the inlet of the compressor indicates liquid returning to the compressor. Check for frost at the end of the freeze cycle. If liquid is returning to the compressor the problem must be located and corrected. See Refrigerant Charge, Thermostatic Expansion Valve and Evaporator.

Harvest Cycle

Once the freeze cycle is complete the machine enters the harvest cycle. The Hot Gas Valve opens to allow hot discharge gas to enter the evaporator.

Hot Gas Valve

When the machine enters harvest the hot gas valve coil is energised and the hot gas valve opens. Discharge gas is pumped through the hot gas valve directly into the evaporator. The evaporator temperature will reach approximately 4.5°C (40°F). The suction pres. sure during harvest should reach a minimum of 5 bar (70 psi.). The head pressure will drop during harvest.

If a hot gas valve does not open completely during harvest there will not be enough hot gas in the evaporator to defrost the ice. This can be checked by watching the suction pressure during harvest. If there is not enough hot gas entering the evaporator the suction pressure will be lower then the pressures stated above. It is important that the machine has the proper refrigerant charge, a normal head pressure during freeze and the compressor is working properly when making this check. Use the Troubleshooting Trees in section C if not sure.

If the hot gas valve leaks during the freeze cycle ice will not form on the top of the evaporator and the suction pressure will be higher than normal. To check the hot gas valve to see if it is leaking, let the machine run in the freeze cycle for approximately 5 minutes, now feel the difference in temperature between the inlet and outlet of the valve. A definite temperature difference should be felt. If so the problem is not the hot gas valve. If the lines are the same temperature and the suction pressure is higher than normal, the hot gas valve is leaking and should be replaced.

Remote System

Machines that use remote condensers have several components that are not used in self contained machines. A Mixing Valve controls the head pressure when the ambient temperature at the condenser drops below 20°C (70°F). When the bin fills with ice or is turned off at the selector switch, the machine will pump all the refrigerant into the receiver before shutting off.

Remote Condenser

Important:
For proper operation the remote condenser must be installed properly. Improper installation will void the warranty. See remote install guidelines on page Al0.

The location of the remote condenser should be such that the ambient air temperature does not exceed 43°C (110°F). If ambient temperature exceeds 43°C (110°F) ice production will decrease until ambient temperature decreases. Air is pull upward through the condenser from the bottom by the fan motor.

The condenser coil and fan blades must be kept clean. The condenser can be cleaned with compressed air or by using a brush. If a brush is used, brush in the direction of the fins taking care not to bend the fins. If condenser fins are bent this will also restrict air

flow through the condenser and the fins will need to be straightened with a fin comb.

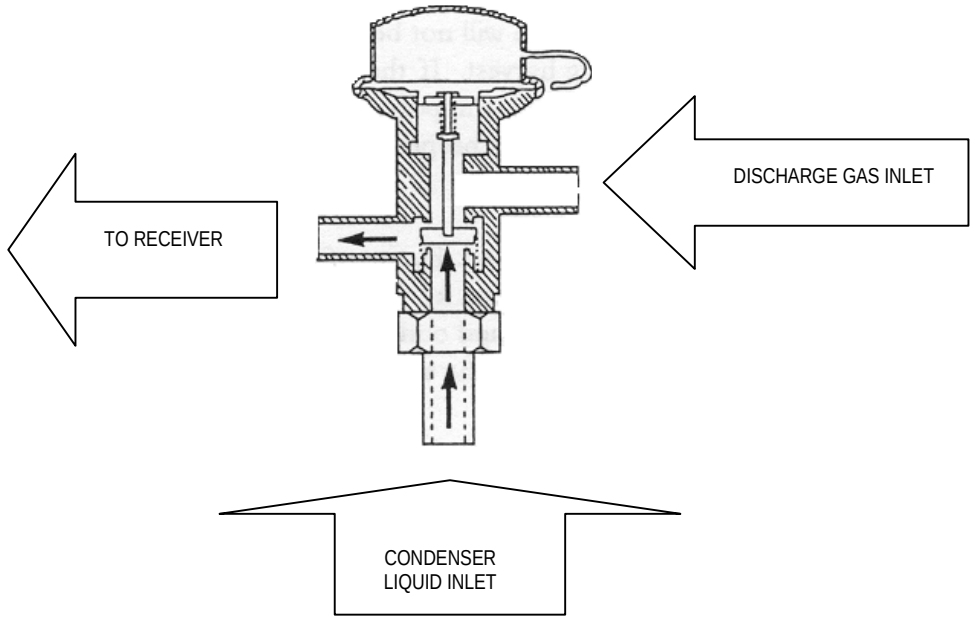
If the air flow is restricted or the condenser is dirty the head pressure will be excessively high, slow production will result and the compressor may overheat and eventually become damaged. Problems related to dirty condenser or poor air flow will not be covered under warranty.

Note: The condenser fan motor runs continuously, it will shut off only when the ice machine is off.

Mixing Valve

When the temperature at the condenser is above 20°C (70°F), the refrigerant flow from the compressor is directed by the mixing valve through the condenser and into the receiver. When the temperature at the condenser drops below 20°C (70°F), the pressure in the bellows of the mixing valve becomes greater than the pressure of the liquid refrigerant coming from the condenser. This

change allows the valve to partially restrict the flow of liquid refrigerant leaving the condenser. This allows discharge gas to by-pass the condenser and flow directly into the receiver, mixing with the liquid refrigerant from the condenser. The amount of discharge gas that by-passes the condenser increases as the ambient temperature at the condenser decreases. This action of the mixing valve allows the head pressure to be maintained at approximately 16.5 bar (240 psi.) on MV 100 Series units during low ambient conditions. The remote system depends on an adequate refrigerant charge in order for the system to remain balanced during ambient temperature changes. If the refrigeration system is undercharged and the ambient temperature is below 20°C (70°F) the mixing valve will not work properly. The mixing valve will allow too much refrigerant to bypass the condenser.



Problem	Possible Cause	Remedy
1. Head pressure low /liquid line between valve and receiver cold. Ambient condenser temp. below 20°C (70°F).	a. Valve defective, not allowing discharge gas into receiver.	a. Replace valve.
2. Head pressure low /liquid line between valve and receiver hot.	a. System low charged. b. Valve defective, not allowing enough sub-cooled liquid into receiver.	a. Find and repair leak if present. Recover refrigerant and weigh in proper charge. b. Replace valve.
3. Head pressure high/liquid line returning from condenser is cool. Ambient condenser temperature above 20°C (70°F)	a. Valve defective, not allowing refrigerant to circulate through condenser.	a. Replace valve.

Pump Down System (Remote Only)

The pump down system prevents liquid refrigerant from migrating to the evaporator and compressor during the off cycle and prevents the compressor from slugging or starting under excessive load.

Liquid Line Solenoid

When a machine with a remote condenser shuts off, the **liquid line solenoid** valve is de-energized causing the valve to close. The valve is located at the outlet of the receiver. When the valve closes the flow of refrigerant leaving the receiver is completely restricted, see diagram above. The compressor pumps all of the refrigerant into the condenser and **receiver.**

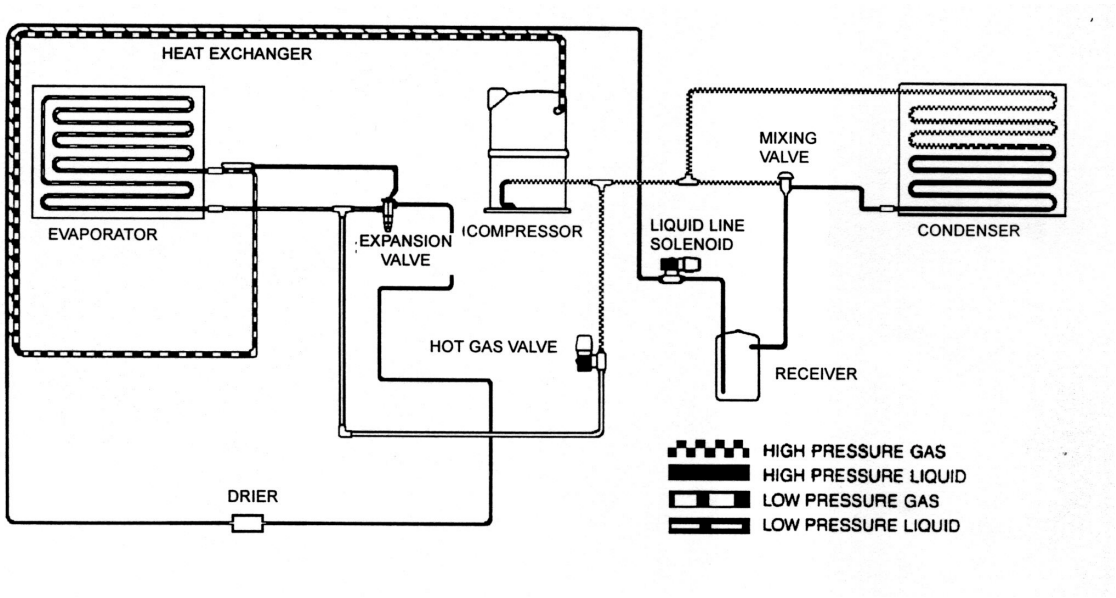
As the system pumps down, the pressure on the low side of the system drops. When the suction pressure drops to 1.3 bar (19 psi) the pump down control opens and the machine shuts off. See page 47 for pump down control operation. Liquid refrigerant is stored in the condenser and receiver while the machine is off.

When the machine comes back on (the bin switch closes or the selector switch is turned to the ICE position), the liquid line solenoid valve opens and the refrigerant is released from the receiver. When the suction pressure rises to 3 bar (45 psi) the pump down control closes and the machine comes back on.

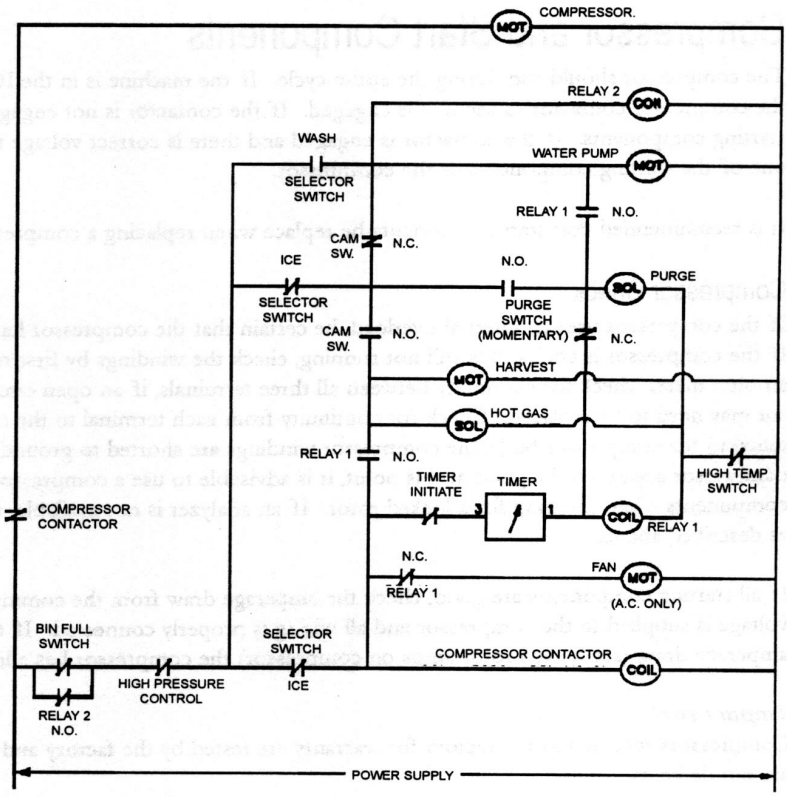
If the machine will not pump down it may because the valve is not closing all the way. A weak compressor will also prevent the machine from pumping down. Check for signs of a weak compressor before replacing the liquid line solenoid. Also before replacing valve disassemble valve and check for obstructions or other problems that may not allow it to seat.

Receiver

If the system has a remote condenser the refrigerant will enter a receiver before passing through the filter drier. The receiver holds reserve liquid refrigerant during the freeze cycle. The receiver also stores liquid refrigerant during the off cycle.



Shown in the Timed portion of the freeze cycle
Both 115V and 230V circuits apply



Control Circuit

All machines in this manual are controlled basically the same way.

Selector Switch

The selector switch is used to put the machine into the ICE making or WASH cycle or to turn the machine OFF. The WASH position allows only the water pump to run and is used during the cleaning process to pump cleaning solution throughout the water system. When the selector switch is turned to the ICE position the machine begins the freeze cycle.

Contactor

When the selector switch is in the ICE position the contactor coil is energized. This energizes the compressor start components which start the compressor.

Purge Switch

The purge switch is a momentary switch used to manually energise the purge valve. It is used during the cleaning process to flush the cleaning solution from the water trough. The purge valve will remain open as long as the switch is depressed.

The N.C. (normally closed) contacts of the purge switch also create a circuit to Relay#1. These contacts should remain closed unless the switch is depressed If the switch is defective and the N.C. contacts are open when the machine enters harvest the machine will return to freeze when the timer initiate cuts-out.

Compressor and Start Components

The compressor should run during the entire cycle. If the machine is in the ICE position but the compressor is not running check the compressor contactor to see if it is engaged. If the contactor is not engaged the problem is not with the compressor or the starting components. If the contactor is engaged and there is correct voltage through the contactor there could be a problem with one of the starting components or the compressor.

It is recommended that start components be replace when replacing a compressor.

Compressor Check

If the compressor uses an internal overload, be certain that the compressor has cooled and the overload has reset before diagnosing. If the compressor is cool and is still not running, check the windings by first removing the wires at the compressor terminals. With an ohm meter, check for continuity between all three terminals, if an open circuit exists between any of the terminals the compressor may need to be replaced. Check for continuity from each terminal to the compressor body, if continuity is found from any terminal to the compressor body, the compressor windings are shorted to ground and the compressor will need to be replaced. If the compressor appears to be good at this point, it is advisable to use a compressor analyser to isolate the compressor from the start
components while checking for a locked rotor. If an analyzer is not available, the compressor starting components must be checked, as described above.

If all starting components are good, check the amperage draw from the common terminal of the compressor, making sure proper voltage is supplied to the compressor and all wiring is properly connected. If the compressor does not start and there is excessive amperage draw, (see locked rotor amps on compressor) the compressor has a locked rotor and should be replaced.

Important

Compressors returned to the factory for warranty are tested by the factory and will not be covered under the warranty policy if they are not defective.

Overload (External only)

If there is no amperage draw check the compressor overload. The compressor overload can be checked for continuity after removing it from the compressor and letting it cool to room temperature. If there is no continuity between the two terminals replace the overload. If the overload is suspected of opening prematurely it is best checked by replacing it with an overload which is "known to be good".

Capacitors

The Start Capacitor is an electrical storage device used to provide starting torque to the compressor. If a start capacitor is defective the compressor will not start properly.

The run capacitor is an electrical storage device used to improve running characteristics and efficiency of compressor. The Run Capacitor is not used on all models. If a .run capacitor is defective the compressor will draw too much current while running.

Before checking a capacitor, it should be discharged by shorting across the terminals. If a run or start capacitor is cracked, leaking or bu1ging it should be replaced. If a capacitor is suspected of being defective it can easily be checked by replacing it with a capacitor of the correct size which is "known to be good", if the compressor starts and runs properly replace the original capacitor, A capacitor tester can also be used.

Start Relay

The start relay breaks the electrical circuit to the start windings when the compressor motor speed increases. If the relay is defective the compressor will not start or it may start but will run for a very short time.

A compressor relay can be checked by removing the relay and checking the relay contacts for damage and check for continuity across the closed relay points. Check the relay coil with a ohm meter. If no continuity is read, replace the relay.

Untimed Freeze Cycle

During the freeze cycle the compressor, water pump and condenser fan motor(s) (if used) are running. On remote machines the liquid line solenoid is also energized, see Refrigeration Section. As ice forms on the evaporator, the suction pressure drops. The machine is in the untimed portion of the freeze cycle and will remain in untimed freeze until the suction pressure drops low enough to close the timer initiate. See page El for operating pressures.
If the machine has two evaporators, Relay#2 will energize and send power to the freeze timer when the timer initiate closes. If the machine has only one evaporator power goes directly to the freeze timer once the timer initiate closes.

Timer Initiate

The timer initiate is a low pressure control that cuts-in (closes) on pressure drop. When the Timer initiate closes, the freeze timer is energized and the machine enters the timed portion of the freeze cycle. When the machine enters harvest and the suction pressure rises the control cuts-out (opens). The timer initiate should close at the pressure indicated in the chart below;

Model Number	Cut-in above 1500 m (5000 ft.)	Cut-in at 600-1500 m (2000-5000 ft.)	Cut-in at 0-600 m (0-2000 ft)
MV 100 W MV 100 R	2,4 bar (35 PSI) 2,55 bar (37 PSI)	2,55 bar (37 PSI) 2,5 bar (36 PSI)	2,3 bar (33 PSI) 2,4 bar (35PSI)

Note: The timer initiate is factory set and does not normally need to be adjusted. If the ice bridge thickness is incorrect the freeze timer should be adjusted rather than the timer initiate. See page 41 for freeze timer adjustment procedure. The timer initiate may need to be adjusted if excessive time (more than 5 minutes) is needed on the timer to achieve proper bridge thickness or if very little time (less then 1 minute) is needed on the timer to achieve proper bridge thickness. See below.

If the timer initiate is suspected of being out of adjustment or not operating properly, check the control as follows:

If the machine has two evaporators, connect a suction gauge to the machine and turn the selector switch to the ICE position. Relay#2 should energize when the timer initiate cuts-in. Note the suction pressure at this time. Adjust the timer initiate if the cut-in point does not match the chart. When the machine enters harvest the timer initiate should cut-out de-energizing the relay. The cut- out point can differ from the chart a few psi either direction without effecting the operation. The differential is not adjustable.

If Relay#2 does not energize or if the machine has one evaporator make the following check. On single evaporator units make sure the high temperature safety control is not open, see page 45. Turn machine OFF and disconnect incoming power by unplugging the machine or switching the circuit breaker OFF. Attach one lead of a voltmeter to terminal 1 and the other lead to terminal 2 of the timer initiate. Reconnect incoming power and turn the machine to the ICE position. Connect a suction gauge to the machine. The Volt Meter should read line voltage until the Timer initiate cuts-in at which point it should read OV: Note the suction pressure at this point. Adjust the timer initiate if necessary. Turning the adjusting screw C.C.W lowers the cut-in and cut-out point. If the control cannot be adjusted to the correct pressure setting or in the cut-in point is erratic the control must be replaced. If the suction pressure is not dropping properly see the Troubleshooting Tree 'Machine Does Not Enter Harvest" in section C.

Relay#2

On dual evaporator machines, the freeze timer is energised through Relay#2. When the timer initiate closes Relay#2 is energised sending power to the freeze timer. When energised, Relay#2 also bypasses the bin controls so that if one or both bin controls open during timed freeze the machine will not shut off. Relay#2 will de-energise when the timer initiate opens during harvest.

On single evaporator machines, Relay#2 is used only to bypass the bin control during the freeze cycle and the first part of the harvest cycle. Relay#2 is energized through the normally closed contacts of the cam switch at the beginning of the freeze cycle. When energized Relay#2 will prevent the machine from shutting off if the bin switch opens. The relay will remain energized until the cam switch is lifted onto the high part of the cam during harvest. At this time the machine will shut off if the bin switch is open.

If Relay#2 is suspected of being defective it can temporarily be interchanged with another relay, if the problem still exists check for voltage across the relay coil terminals of the relay socket. If line voltage exists and the relay does not energize, the socket is defective. If there is no voltage the problem is elsewhere.

Relay#2 is not used on under counter models.

Timed Freeze

When the freeze timer is energized, the machine is in the rimed portion of the freeze cycle. The freeze timer will rime out the remainder of the freeze cycle. Once the rime has passed, the machine will enter the harvest cycle.

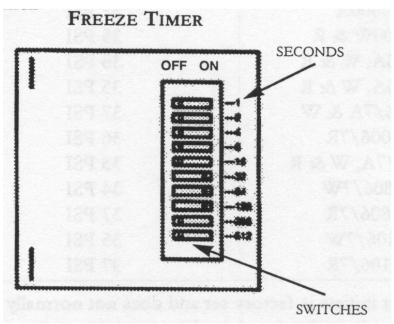
Freeze Timer

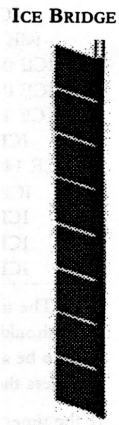
The freeze timer is an adjustable timer used to control the ice bridge thickness. The freeze timer is factory set but may need to be adjusted upon initial start-up of the machine. When time is added to the freeze timer the length of the freeze cycle is increased, therefore the ice bridge thickness is increased. When time is removed from the timer, the freeze cycle is shorted and the ice bridge thickness is decreased.

The freeze timer can be adjusted by sliding one or more switches to either the ON or OFF position to obtain the setting which will produce the proper ice bridge thickness.

Ice bridge thickness should be approx 1/8in (3mm). If bridge is too thick remove enough time from timer to achieve proper thickness. If bridge is too thin add enough time to timer to achieve proper thickness.

Check the freeze timer for proper operation as follows: Make sure that the high temperature safety is not open, see page 45. Turn the machine OFF and disconnect incoming power by unplugging the machine or switching the circuit breaker OFF. Attach one lead of a voltmeter to terminal l and the other lead to terminal 3 of the timer. Reconnect incoming power and turn the machine to the ICE position. The volt meter should read 0 volts until the timer initiate closes at which point the timer will energize and line voltage should be read. On dual evaporator machines Relay#2 should energize when the timer initiate closes, if it does not check the timer





initiate and Relay#2, see pages 40 and 41. When the timer counts out the volt meter will again read 0 Volts. The time it takes the freeze timer to time out, once it has been energized, should match the timer adjustment. If it does not or if the timer never closes, the timer is defective.

Harvest Cycle

Once the freeze timer has counted out, power is sent to **Relay#1** and the machine enters the harvest cycle. Once in harvest, the **purge valve, hot gas valve(s)** and **harvest motor(s)** are energized. The water pump continues to run during the first part of the harvest cycle so that mineral laden water remaining in the water trough can be pumped through the purge valve to the drain. The harvest motor turns the clutch assembly to actuate the cam switch. There is one harvest assist assembly (harvest motor, clutch, probe and cam switch) for each evaporator. The cam switch is in the normal position during freeze and at the beginning of harvest. Once the clutch turns far enough to actuate the cam switch the water pump and purge valve de-energize. The harvest motor continues to turn the clutch. When the cam switch (both cam switches on dual evaporator machines) return to the normal position the machine returns to the freeze cycle.

If the bin switch is open when the cam switch is actuated by the high part of the cam, the machine will shut off. Remote units pump down before shutting off.

Relay#1

When Relay#1 is energized, the normally open contacts (l-B) close sending power to the hot gas valve and harvest motor. The N.O. contacts (l-A) close sending power to the purge valve. The N.O. contacts (l-A) also send power to the coil of Relay#1 to keep the relay energized when the timer initiates opens. On self contained air cooled models with one evaporator the N.C. contacts (l-B) keep the condenser fan motor energized during freeze, when the contacts open during harvest the condenser fan motor is de-energized.

If Relay#1 is suspected of being defective, it can temporarily be interchanged with another relay, if the problem still exists check for voltage across the relay coil terminals of the relay socket. If line voltage exist and the relay does not energize, the socket is defective. If there is no voltage the problem is elsewhere.

Relay#2

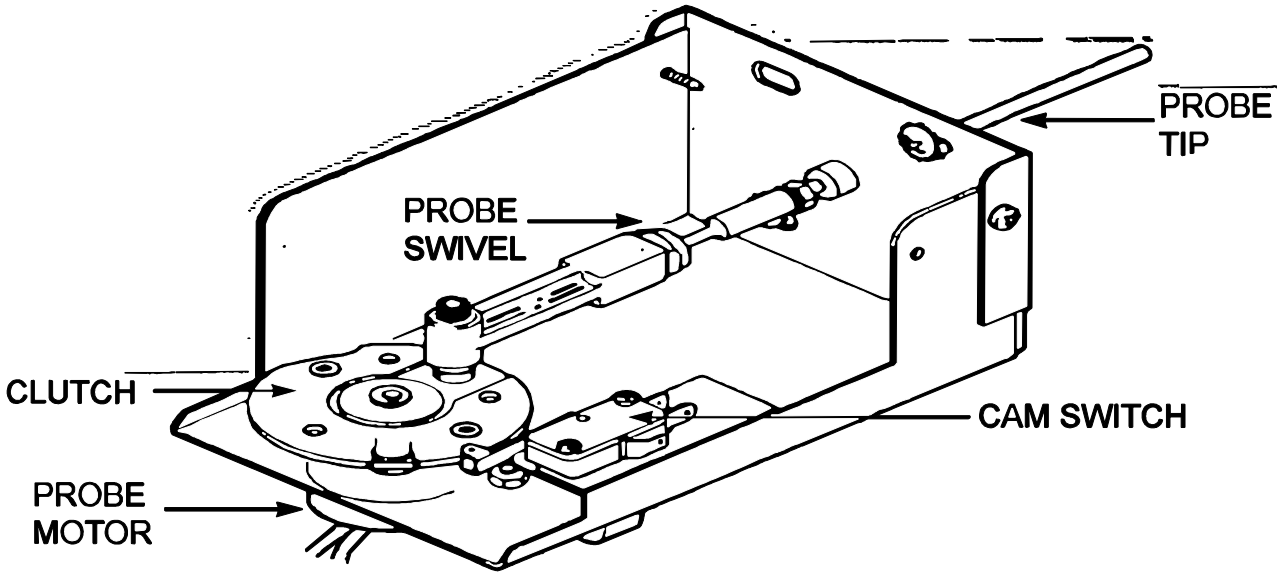
See page 41.

Relay#3

Relay#3 is used on all dual evaporator machines and single evaporator machines with Remote condensers.

Dual evaporator machines: Relay#3 is energized during harvest. When energized the N.C. contacts open to shut the condenser fan motors off on self contained air cooled machines. The N.O. contacts of Relay#3 close during harvest to bypass the bin switches preventing the machine from shutting off during harvest if one or both bin switches open. When Relay#3 de-energizes at the beginning of freeze, the N.O. contacts return to the open position and the machine will shut off if one or both bin switches are open.

Single evaporator remotes: Relay#3 remains energized until the machine is turned off or shuts down due to an open bin switch or an open high pressure safety. When the relay de-energizes. the N.O. contacts that power the condenser fan motor open. shutting the fan motor off. When the machine is reset or turned back on, Relay#3 energizes and the N.O. contacts close to bypass the pump down control. This allows the compressor contactor to energize before the suction pressure is high enough to close the pump down control.



Harvest Assist Assembly

There is one harvest assist assembly on the MV 100 units. The Harvest Assist Assembly has two purposes; to assist in moving the ice off the evaporator and to control the length of harvest. When the machine enters harvest power is sent to a harvest motor which turns a slip **clutch.** A **probe** is attached to the clutch and is pushed against the back of the ice slab as the clutch turns. The clutch begins to slip when the probe applies approximately 8 oz of pressure against the ice slab. It takes approximately 1 minute for hot gas to heat the evaporator enough to loosen the ice from the evaporator plate. At this point the clutch pressure overcomes the capillary attraction of the ice to the evaporator plate and the ice begins to move off of the evaporator. As the ice is being pushed the clutch stops slipping and begins to turn, extending the probe enough to push the ice completely off the evaporator plate.

Once the ice has been moved off the evaporator plate, the harvest components must be de-energized as quickly as possible so another freeze cycle can begin. This is done with the **cam switch.** The actuator arm of the cam switch rides against the cam portion of the clutch which actuates the switch as the clutch turns. When the clutch makes one complete revolution and the cam switch drops to the low part of the cam and the machine returns to freeze. When in freeze the probe is retracted and is no longer in the freeze area of the evaporator.

Harvest Motor

The harvest motor is energized at the beginning of harvest and on single evaporator units will remain energized until the machine returns to the freeze cycle. On dual evaporator machines, one harvest motor will usually de-energize while the machine is stil1 in harvest and the other will remain energized until the machine returns to freeze.

A defective harvest motor will usually not run. The harvest motor runs in a Clockwise direction. It is possible for a defective motor to run backwards (C.C.W:). If this happens the motor must be replaced. It is also possible for a defective motor to "bump" backwards immediately when entering harvest. This will cause the machine to return to freeze immediately after entering harvest. if the machine is in harvest only for a split second the harvest motor may be defective. Verify the motor is defective by watching the clutch closely when the machine enters harvest.

Clutch Assembly

The clutch assembly consists of a slip clutch and cam. A probe is attached to the clutch assembly and the harvest motor turns the clutch during harvest. As the harvest motor turns, the clutch will slip while the probe is pushed against the ice. The clutch will continue to slip as long as the pressure required to move the ice is greater the 8oz. Once the evaporator has heated enough to break the bond of ice to the evaporator, the pressure required to move the ice becomes less then 8oz. and the clutch begins to turn.

The clutch assembly is not adjustable. If the clutch tension is weak (less then 8 oz. of pressure), a slow harvest or excessive ice meltage during harvest will result. If the clutch pressure becomes too tight, the force of the probe against the back of the ice may cause the slab to break and the ice may not fall off of the evaporator. There is no exact way to measure clutch tension. If the clutch tension is suspected of being too tight or too weak, turn the clutch by hand, the clutch should turn smoothly without "grabbing". The clutch should be easy to turn by hand but should offer some resistance. If in doubt as to whether or not the clutch is defective, compare the tension with one that is known to be good.

Probe Tip and Swivel

The probe tip is attached to the clutch and makes contact with the back of ice slab during harvest. The swivel allows the probe tip to pivot as the clutch turns So that the probe is pushed straight through guide h01es.

The tip of the probe should be flush with the back of the evaporator or recessed up to 1.5 mm (1/16in). The Probe Tip must not extend into the freezing area of the evaporator during freeze.

The length of probe tip is adjustable by loosen the lock nut that tightens against the swivel and screwing probe tip in or out of swivel. Once the probe has been adjusted to proper length tighten the lock nut.

If the probe tip binds during operation it may cause the clutch to slip unnecessarily. This may occur if the harvest motor mounting bracket is not aligned properly or if the probe tip has a excessive build up of mineral deposits on it. Remove and clean the probe if necessary.

To check the probe tip for binding, remove the shoulder bolt holding the probe to the clutch and simulate the movement of the swivel and probe by moving the swivel in a circular motion around the outer portion of the clutch. The probe should slide in and out or the guides without resistance. The swivel should also move freely. If any resistance is felt the bracket should be adjusted. Loosen two screws holding harvest motor mounting bracket in place and reposition the bracket until the probe moves freely. This check should be made whenever the harvest assist assembly is removed for any reason.

Cam Switch Operation Single Evaporator Machines

The actuator arm of the cam switch rides on the edge of the clutch assembly and is actuated by the high and low part of the cam.

When the machine is in the freeze cycle the actuator arm of the cam switch is in the low part of the cam. During freeze power is supplied to the water pump and Relay#2 through the N.C. contacts of the Cam Switch. When the machine enters harvest, power is supplied to the water pump and purge valve through the N.C. contacts of the cam switch and through the N.O. contacts of Relay#1 (closed during harvest). The water pump, purge valve and Relay#1 remain energised until the cam switch is lifted on to the high part of the cam. Relay#2 will also de-energise at this time allowing the machine to shut off if the bin switch opens.

When the clutch makes a complete revolution, the cam switch drops into the low part of the cam and the N.O. contacts return to the open position returning the machine to freeze.

Cam Switch Operation Dual Evaporator Machines

When the machine is in the freeze cycle, the actuator arm of both cam switches are in the low part of the cam. The harvest motor and cam switch on the right side are referred to as harvest motor 1 and cam switch 1. Harvest motor 2 and cam switch 2 are on the left side.

During freeze power is supplied to water pump through the N.C. contacts of cam switch 1. When the machine enters harvest, power is supplied to the water pump and purge valve through the N.C. contacts of cam switch 1 and through the N.O. (closed during harvest) of Relay#1. Power is supplied to Relay#3, the hot gas valve and harvest motor 2 through the N.C. contacts of cam switch 2. The water pump, purge valve and Relay#1 will remain energised until cam switch 1 is on the high part of the cam. Power to harvest motor 1 will be maintained through the N.O. contacts of cam switch 1 which are now closed. When cam switch 2 is lifted onto the high part of the cam, power is maintained to Relay#3, the hot gas valve and harvest motor 2 through the N.O. contacts of cam switch 2 which are now closed. Once cam switch 2 falls back into the indentation the machine will return to freeze if cam switch 1 has already fallen into the indentation. If cam switch 1 is still on the high part of the cam the machine will remain in harvest until it returns to the low part of the cam.

Cam Switch Adjustment

Check the switch for proper adjustment by slowly turning the clutch by hand in a C.C.W direction while listening for the switch contacts to change. The switch should "click" just before the roller reaches the high part of the cam. Now slowly turn the clutch in a C.W direction and the switch should "click" just before the roller reaches the low part of the cam. Adjust the switch by loosening the mounting screws and moving the position of the switch.

Important!

If the cam switch is suspected of being defective it should be checked with an ohm meter. It should not be assumed that the switch is good because a "click" can be heard when moving the actuator arm.

High Temperature Safety

The high temperature safety is a thermal disc that protects the machine if the machine "sticks" in the harvest cycle. The high temperature safety is clamped to the suction line near the T.X.V: sensing bulb. It opens when the suction line temperature reaches 50°C (120°F) and closes when the temperature drops to 27°C (80°F). If the high temperature safety opens during harvest it will de- energise the harvest components.

If the high temperature safety is defective and fails during freeze it will not allow Relay#1 to energise and the machine will not enter harvest. If the High Temperature Safety is suspected of being defective push the purge switch and listen for the Purge Valve to energise. If the purge valve does not energise it is probable that the high temp. safety is defective. Remove the high temp. safety and check it with an ohm meter to verify that it is defective

Important

Do not allow the machine to operate without the High Temperature Safety. Damage to the machine may result and the warranty will be void.

Bin Control Operation

The bin control is used to shut the machine off when the bin fills with ice. The bin control must be checked upon instal1ation or initial start-up and when performing maintenance. Adjustments are not covered under warranty.

There is one bin switch for each evaporator. The bin switch is located behind the side panel and mounted to the side of the machine. The actuator arm of the bin switch protrudes through the side of the machine and comes in contact with the splash curtain. When the bin is full of ice the splash curtain is held open when ice drops off the evaporator. This releases the pressure of the bin switch actuator arm allowing the switch to open.

Single evaporator machines: If the bin switch opens during freeze or the first part of harvest, Relay#2 bypasses the bin switch
and the machine will continue running. If the bin switch is open during harvest when the cam switch is lifted onto the high part of the cam the machine will shut off. When the bin switch closes again the machine will restart.

Dual evaporator machines: If either bin switch opens during the untimed portion of the freeze cycle the machine will shut off. If the either bin switch opens during timed freeze or the first part of harvest. Relays 2 and 3 bypass the bin switch and the machine will continue running. If either bin switch is open when the machine returns to the freeze cycle the machine will shut off.

Under Counter Machines: A thermostatic bin control is used on under counter models. The bin thermostat is located in the control box with a capillary tube which is in a brass tube mounted to the water trough. When ice comes in contact with the capillary tube housing the bin thermostat opens and the machine shuts off.

Bin Control Adjustment

All Models (except Under Counter models): Check the bin switch for proper adjustment by swinging the bottom of the evaporator away from the evaporator. Slowly bring the curtain towards the evaporator. The switch should close when the bottom edge of the curtain is even with the outer edge of the water trough. Adjust the switch by loosening the screws that hold the switch mounting plate in place. Move the switch to the proper position and retighten the screws. Recheck the adjustment.

Under Counter Machines: Turn the machine to the Ice or Wash position. Hold *ice* against the brass tube mounted to the water trough making sure *ice* is touching at least 15 cm (6") of the tube. The machine should shut off in approximately 1 minute and remain off for approximately 3 minutes. If a major adjustment *is* needed, turn the adjustment screw C.C.W until *it* stops then turn it C.W 1/8 turn. This should put the control close to the proper adjustment, recheck and make a minor adjustment if needed. If a minor adjustment is needed, turn the adjustment screw C.W (COLDER) to increase the time *it* takes for the machine to shut off and C.C.W for a faster shut down.

Pump Down System (Remote Only)

If a remote machine is shut down either by the selector switch, bin control or high pressure safety, the **liquid line solenoid** is de-energised allowing the valve to close. This blocks the flow of refrigerant causing all the refrigerant to be pumped in to the condenser and **receiver.** This is done to prevent liquid refrigerant from migrating into the compressor during the off cycle, which could cause damage to the compressor upon start-up. As the refrigerant is pumped into the receiver the suction pressure begins to drop, once the suction pressure reaches approximately 1.7 bar (19 psi) the **pump down control** contacts open, de-energizing the compressor contactor.

When the machine is turned back on, power is then supplied to the liquid line solenoid opening the valve and al1owing the suction pressure to rise enough to close the pump down control contacts.

Pump Down Control

The Pump down control is a Low Pressure Control that shuts the machine off when the suction pressure drops during pump down. The control is factory set to Cut-out (open) at 1.7 bar (19psi) and Cut-in (close) at 3 bar (45psi). The pump down control does not normally need to be adjusted, however adjustments may be made by turning the adjustment screw.

MV 100 AIR & WATER COOLED

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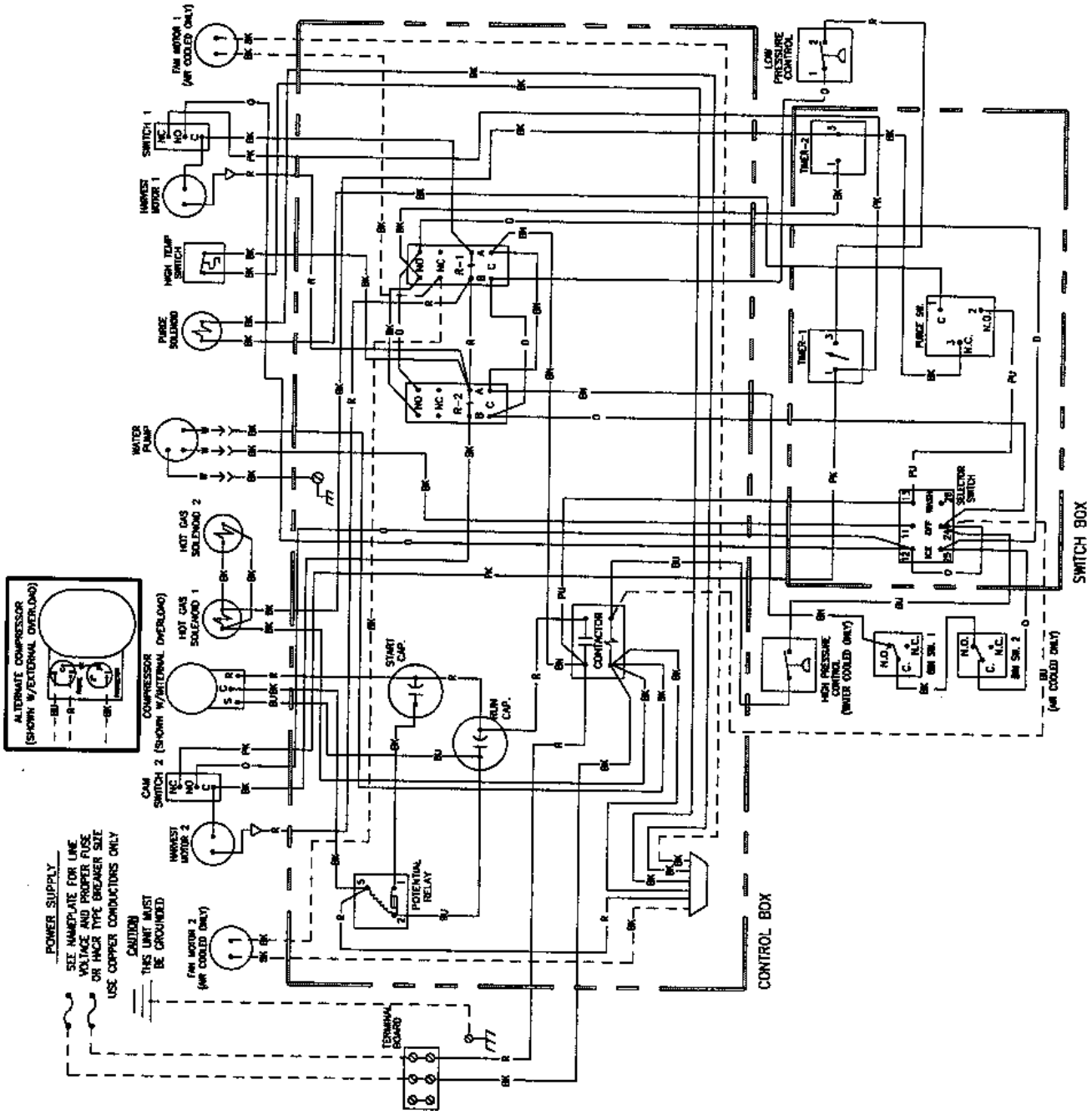

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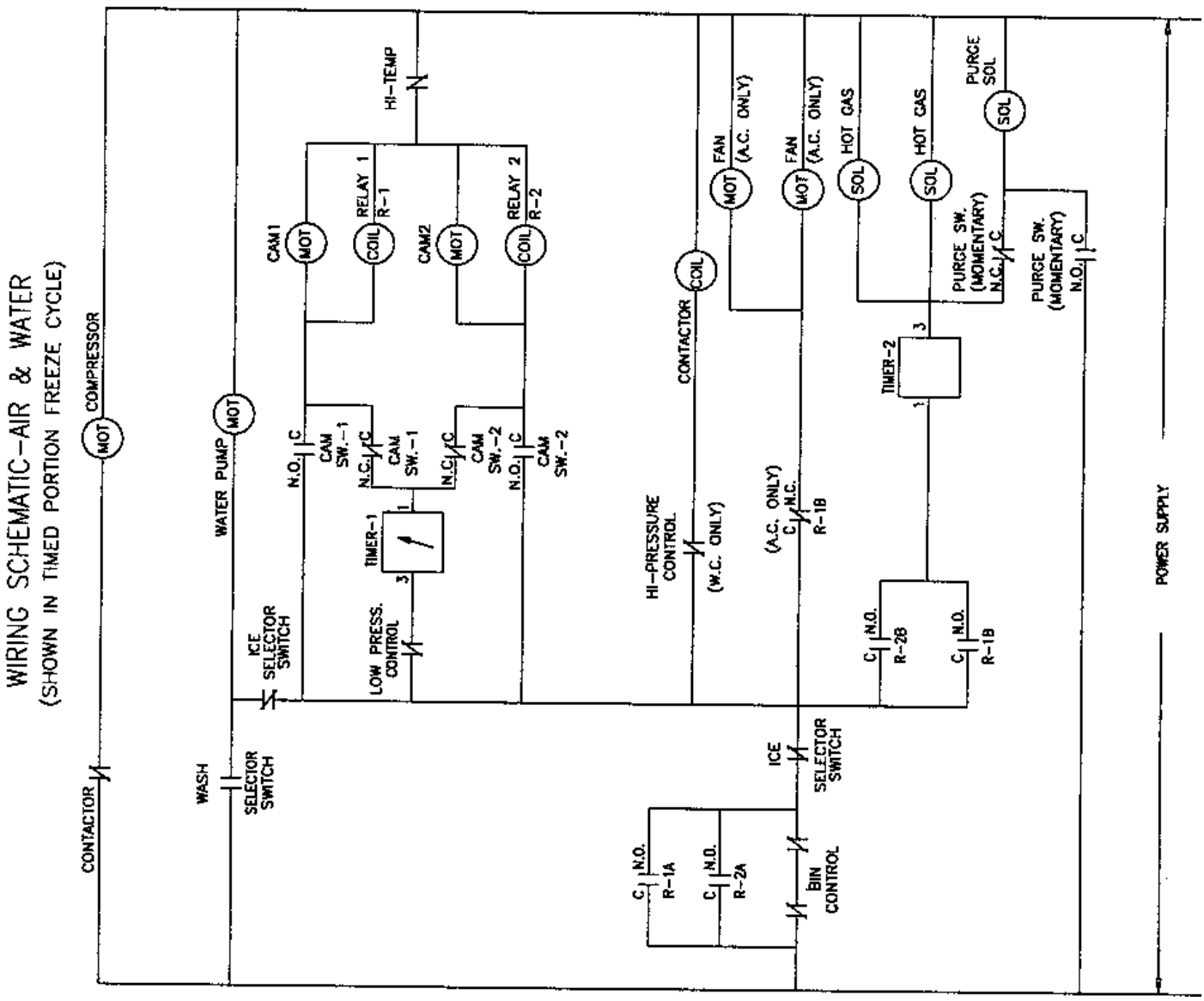

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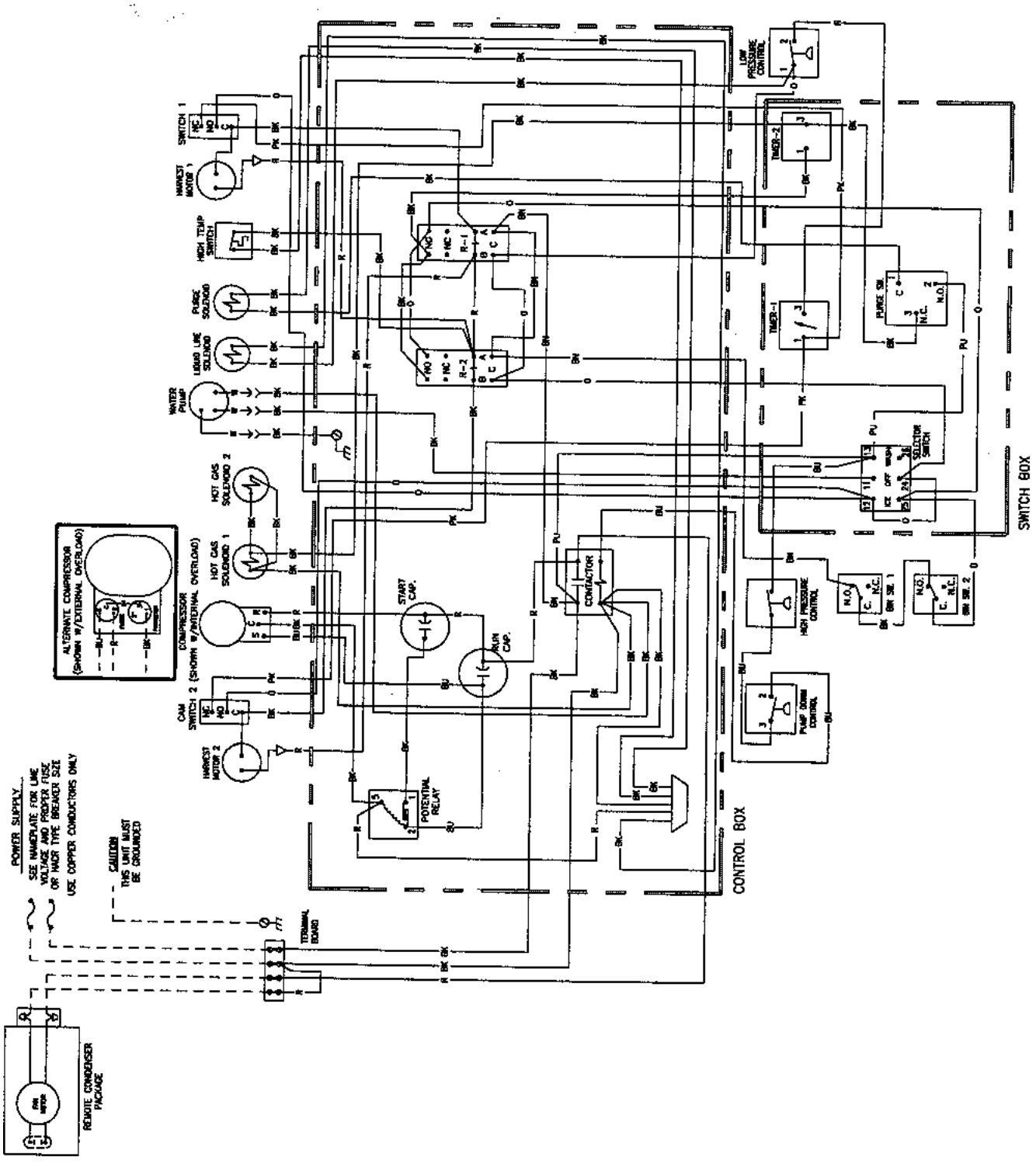

MV 100 REMOTE AIR COOLED

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